ROADS and STREET

HIGHWAYS • BRIDGES • AIR FIELDS • HEAVY CON

Gillette Publishing Co., 23 West Maple St.
Chicago 10, Illinois

JUNE 1956

UNIVERSITY MICROFILMS
EUGENE B. POWER
313 N. 1ST ST.
ANN ARBOR, MICH.
CONP-LRV-11-50

"Blueprint" for $50 Billion Job

...Score of Varied Articles

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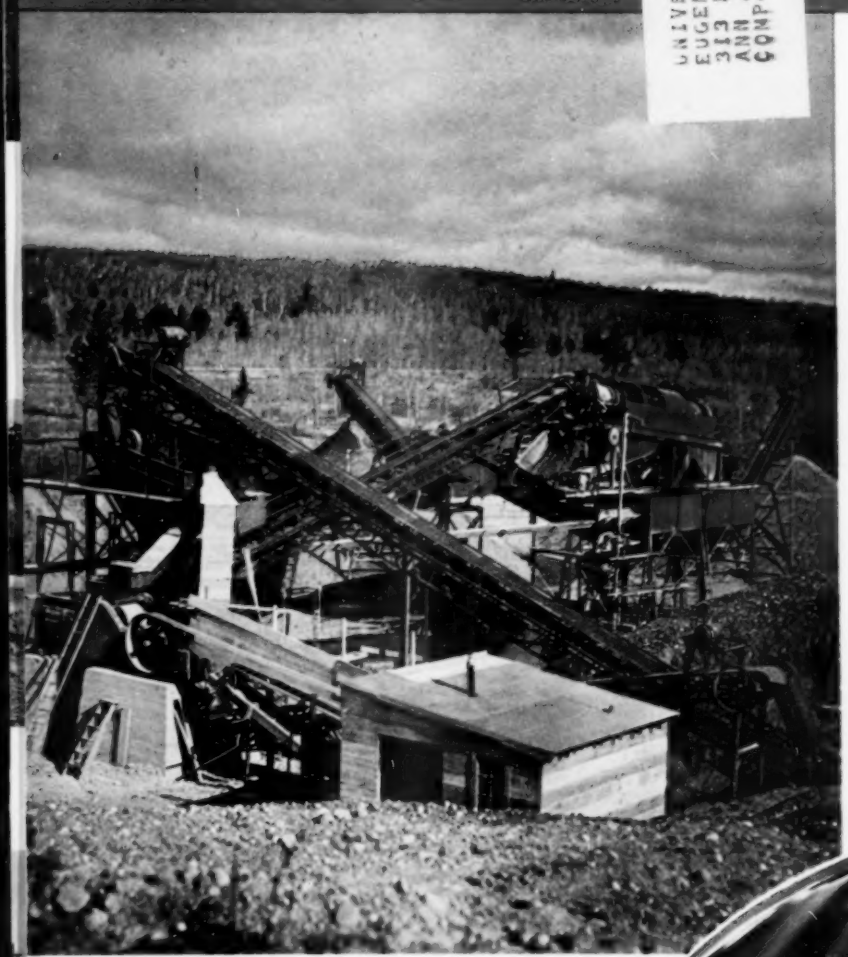
Accepted as Controlled Circulation Publication at Cedar Rapids, Iowa



TIMKEN® BEARINGS KEEP PIONEER WASHING PLANT OPERATING SMOOTHLY, EFFICIENTLY

To keep this washing plant operating at top-notch efficiency and at low cost, Pioneer Engineering Works, Inc., specified Timken® tapered roller bearings. Timken bearings take the heavy loads in the roll crusher and conveyor idlers, assure long bearing life and minimum maintenance—keep machinery on the go. Timken bearings handle all kinds of tough jobs in the construction industry. Specify them for the machines you buy or build — look for the trademark "TIMKEN." The Timken Roller Bearing Company, Canton 6, Ohio. Cable: "TIMROSCO."

TIMKEN
TRADE-MARK REG. U. S. PAT. OFF.

TAPERED ROLLER BEARINGS ROLL THE LOAD

a One Man Show

PHOTO COURTESY BARBER-GREENE COMPANY, AURORA, ILLINOIS

One man and Chrysler-Powered ditcher prepare footings for 953 houses in 77 days!

It's a one man show with this ditcher. Here's the proof . . . one man and the unit pictured prepared all-around footings for 953 slab floor prefabricated houses in eleven weeks. Foundations ranged from 28′ 6″ x 24′ to 48′ 6″ x 24′ 6″. All required footings 8″ wide, dug to depth of 36″ or 42½″.

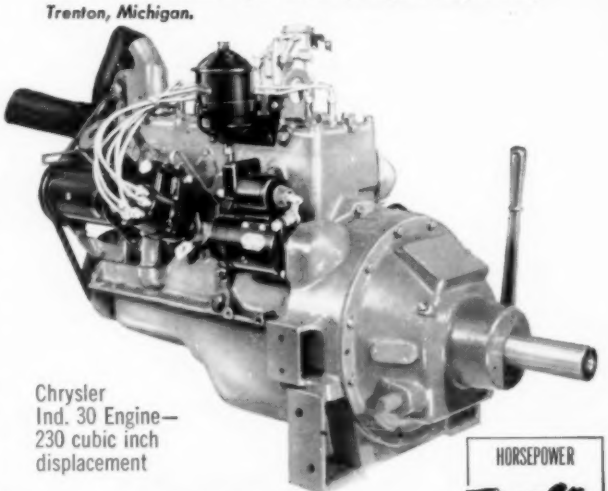
Cuttings were made from dimensional lines drawn directly on the ground. With the vertical boom of the Barber-Greene Ditcher, trenches were dug with vertically straight walls and square ends. No hand digging was necessary.

The operator never exceeded one hour for a set of footings despite the fact that a good many of the foundations were cut into rocky land adjacent to a worked out quarry. Most footings were completed in a half-hour.

The Barber-Greene Runabout Ditcher is designed, built and powered for easy, one-man operation. A single power plant—a Chrysler Ind. 30—230 cubic inch displacement engine—drives bucket line, operates boom and moves the ditcher. Chrysler gyrol Fluid Coupling is teamed with hydraulic transmission for easy coordination of bucket line and crowding speeds. The fluid coupling also takes the shock out of sudden encounters with underground obstacles, "slips" until obstacles are removed.

From 230 to 331 cubic inches displacement, In-Line 6 or V-8, each Chrysler Industrial Engine is a compact, cool-running, highly flexible high-speed engine. Manufacturers specifying Chrysler Power find they can select engines Chrysler-equipped to their requirements. Dual-cooled Chrysler Industrial Torque Converter, gyrol Fluid Coupling, 3, 4 or 5-speed transmissions, heavy-duty clutch and power takeoff, velocity, belt or gear-driven governors—all these and many more accessories are available for order.

See a Chrysler Industrial Engine Dealer, or write direct: ***Dept. 106, Industrial Engine Division, Chrysler Corporation, Trenton, Michigan.***



Chrysler Ind. 30 Engine—230 cubic inch displacement

HORSEPOWER WITH A PEDIGREE

CHRYSLER INDUSTRIAL ENGINES

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Field joints with Beth-Cu-Loy only a matter of minutes

Bolts, a band of Beth-Cu-Loy, and a hand wrench are all you need to make a tight culvert joint right in the field.

Compare this with the man-hours needed to assemble an equivalent culvert of any other material!

Ease of assembly is only one of many reasons for the growing use of drainage pipe made of Beth-Cu-Loy galvanized sheet. The strength of steel permits the use of relatively light-weight material, so that handling is simpler and costs less. Long lengths are feasible, too, reducing the number of joints and speeding up installation of the pipeline.

Trenching can be less finicky because Beth-Cu-Loy pipe is flexible regardless of diameter, easily conforms to grade and alignment. Further, it flexes with the fill to equalize loads around it, and absorbs vibration, impact and shifting actions due to weather.

The copper in Beth-Cu-Loy sheets, along with the heavy zinc coating, provides a double defense against corrosion. Pipe and culvert fabricated from this steel give long and trouble-free service. Bethlehem manufactures the Beth-Cu-Loy galvanized corrugated and flat sheet stock used by pipe fabricators. If you would like to have more information about Beth-Cu-Loy or the names of those who can supply pipe made from it, just call our nearest sales office.

BETHLEHEM STEEL COMPANY
BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

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BETHLEHEM STEEL

BETHLEHEM STEEL

ROADS AND STREETS

A GILLETTE PUBLICATION • JUNE, 1956 • VOLUME 99 • NUMBER 6

"BLUEPRINT" FOR AN EXPANDED HIGHWAY PROGRAM

ROADS AND STREETS Special Staff Report ..... pages 92 through 118

This 19-page review spotlights the formidable problems which will confront the highway and street building agencies of the nation, the contractors and the equipment and material supply industry, if Congress enacts the proposed long-range federal highway program.

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Published monthly. Subscription price $5.00 per year.

OLD EARTH-MOVING HANDS JOIN HARD-ROCK MEN TO MAKE "UNPROFITABLE" IRON MINE PAY OFF!

The Benson Mines, at Star Lake, deep in New York's Adirondacks, have been worked since pre-Revolutionary days—but working the low-grade, nonmagnetic ore by old-time methods wouldn't pay today. Now a 30-unit fleet of 22-cubic-yard trucks, rolling on Goodyear tires, moves mountains to lay the ore body bare. 4-ton drop-balls, with old tires as shock absorbers (as shown above), break blasted rock to crusher size—and ingenious spiral troughs find "pay dirt" by the ton!

Besides stripping overburden of earth, trees and brush, earth-moving hands have endless road-building work—an earmark of open-pit mining.

Goodyear 3-T Nylon Cord Tubeless Tires end tube and flap troubles forever!

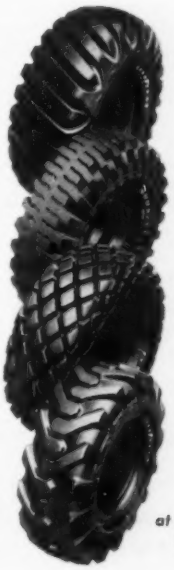
NOW STANDARD AS ORIGINAL EQUIPMENT ON MANY MODELS, Goodyear tubeless tires and rims can also be specified for a wide range of construction and mining vehicles.

And it will pay you to switch to Goodyear TUBELESS on present equipment, too. Here's why:

All regular Goodyear cost-cutting features—PLUS no tube or flap troubles—PLUS no tube replacements—PLUS easier mounting and dismounting—PLUS airtight assembly—PLUS cooler running—PLUS slow leaks instead of blowouts—PLUS easier repairs—PLUS simpler, re-usable valve-parts!

Get all the facts from your nearby Goodyear dealer. Goodyear, Truck Tire Dept., Akron 16, Ohio.

NOW IN 3-T NYLON CORD—CONVENTIONAL OR *TUBELESS!*



HARD ROCK LUG

ROAD LUG

ALL-WEATHER

SURE-GRIP

GOODYEAR TIRES

Look for this sign at your nearby Goodyear dealer's. See him for better tire values —better tire care.

Buy and Specify

GOODYEAR

MORE TONS ARE HAULED ON GOODYEAR TRUCK TIRES THAN ON ANY OTHER KIND

Road Lug, Sure-Grip, All-Weather—T. M.'s The Goodyear Tire & Rubber Company, Akron, Ohio

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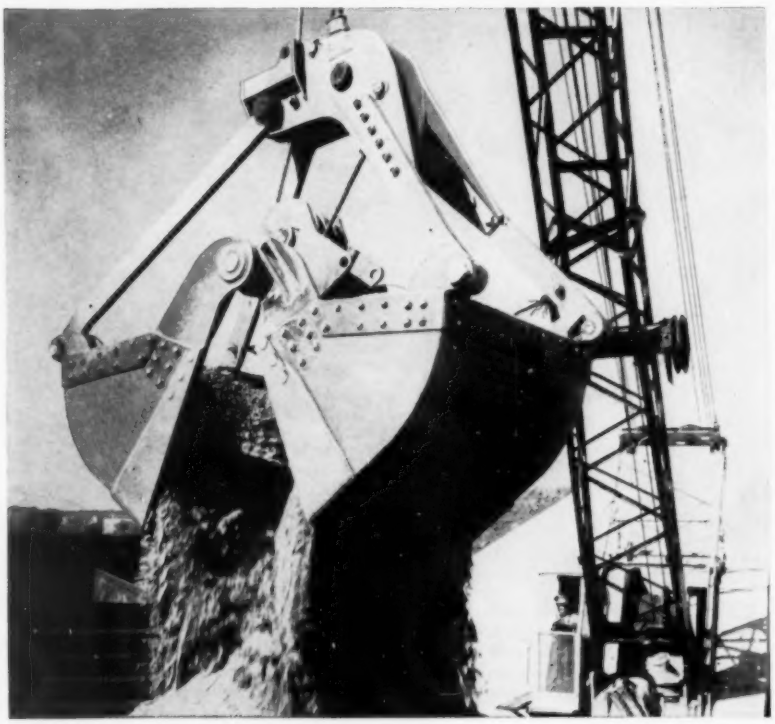
"A CARLOAD EVERY 11 MINUTES WITH OUR ERIE STRAYER BUCKET"



REPORTS DEWEY SLOOP . . . SUPERINTENDENT FORREST PLANT, HOLLIDAY SAND & GRAVEL CO.

Eleven minutes to load a 100,000-pound gondola with sand—less than an hour to fill a 215-ton hopper bucket—that's production! Just 34 seconds per bucket load!

Sand and gravel men must have this swift, efficient production to turn a fair profit. And it's this kind of production the Forrest Plant of the Holliday Sand and Gravel Co. gets day after day with their 1½ yard ERIE rehandler.

ERIE buckets are made for speed. This and the other fine ERIE features cause men like Superintendent Dewey Sloop to volunteer: "The ERIE is the best bucket we've ever had."

Check ERIE's features—then compare prices!

1. **SPEED:** Faster operation from short, powerful closing and opening action.
2. **DURABILITY:** Rigid, one-piece head shrugs off bumps and jars.
3. **LOW HEAD ROOM:** Permits higher stock piling—less frequent repositioning.
4. **LOW MAINTENANCE:** Continuous cable reeving with no reverse-S bends. Less cable to buy.

FOR CATALOGS, WRITE DEPT. RS-66

ERIE — BUCKETS THE WORLD OVER

ERIE STRAYER CO.

3866 GEIST ROAD · ERIE, PENNSYLVANIA

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ROADS AND STREETS

Devoted to the design, construction, maintenance and operation of highways, streets, bridges, bridge foundations and grade separations; the construction and maintenance of airports. Represents 63 years of continuous publishing in the highway field; combined with Engineering and Contracting and Good Roads Magazines, established in 1892.

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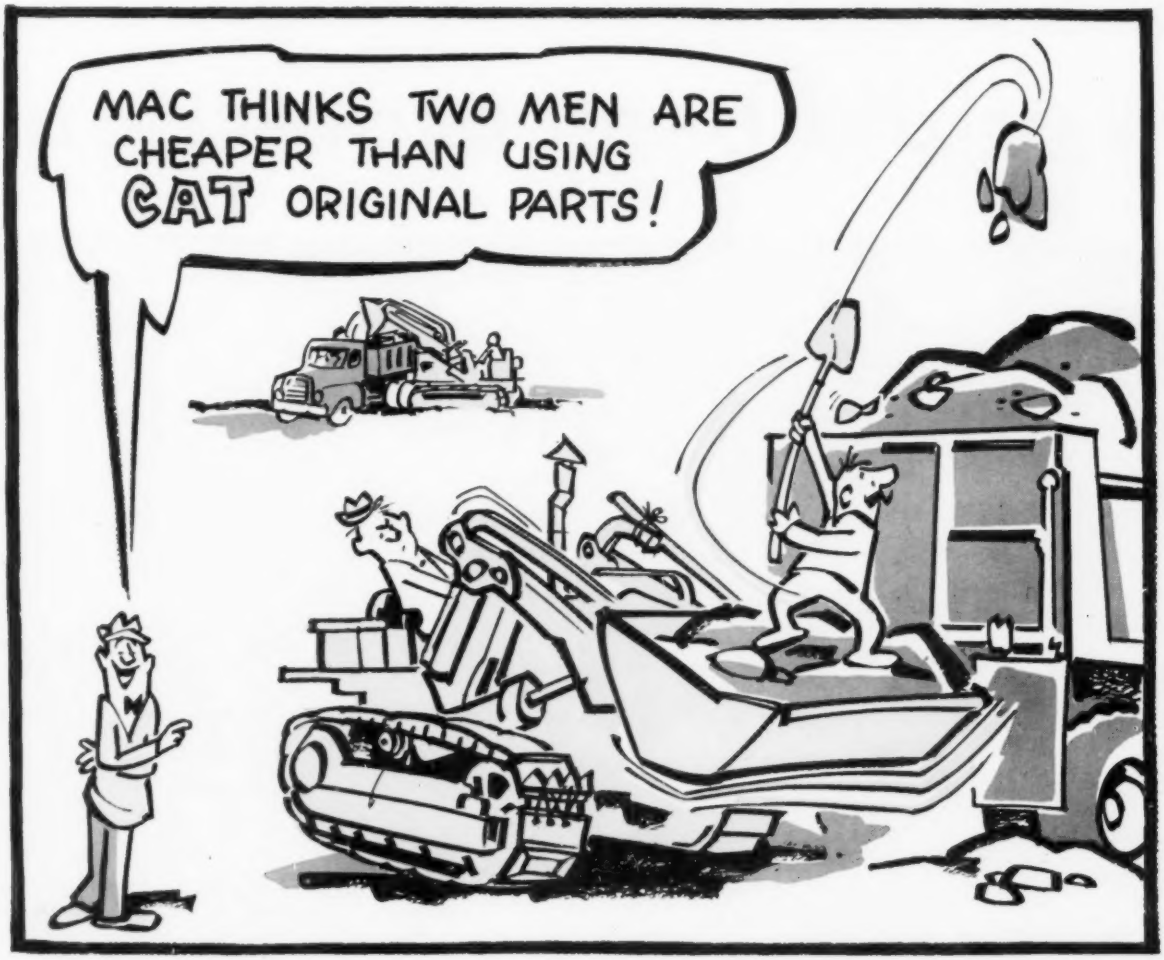

When it comes to parts, don't let "look-alike" substitutes get you off the track.

Genuine Caterpillar track shoes are made of only high-quality rolled steel, specially hardened by an exclusive process. Links are induction-hardened, pretested steel, and their design is the result of years of research and development. CAT* track pins and bushings are also specially hardened, with a deep case and a tough core. You're *sure* you're on the right track with Cat original parts.

With substitute parts, can you be sure of anything?

Better see your Caterpillar Dealer's Parts Representative — and get Cat original parts every time.

Caterpillar Tractor Co., Peoria, Illinois, U. S. A.

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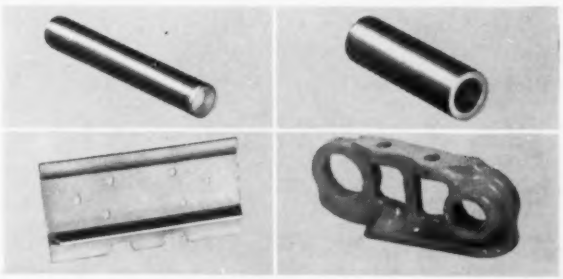

Caterpillar track parts take the brunt of the punishment when the going is toughest. They are subjected to abrasive sand and gravel, brutal shock loads from stumps and rocks. Why take chances with substitutes?

CATERPILLAR*

*Caterpillar and Cat are Registered Trademarks of Caterpillar Tractor Co.

World's best protection

TEXACO SIMPLIFIED LUBRICATION PLAN

Enables you to handle all major lubrication with *no more than six* Texaco Products. Your Texaco Lubrication Engineer will gladly show you how the Plan reduces lubricant inventory, saves time and money, and helps you avoid lubrication mistakes.

TUNE IN:
TEXACO STAR THEATER
starring
JIMMY DURANTE
on television . . .
Saturday nights, NBC.

TEXACO

against wear and rust

TEXACO MARFAK is the name. This famous chassis lubricant clings to metal and seals the working grease within the bearing. Heavy loads won't squeeze it out, rough roads won't jolt it out. Its persistent lubricating film fights wear and prevents rust. Parts last longer, maintenance costs come down.

For wheel bearings, use *Texaco Marfak Heavy Duty*. It seals out dirt and moisture, seals itself in —assuring safer braking and extra thousands of miles between repackings. No seasonal change required.

For those who want a multi-purpose lubricant, *Texaco Marfak Heavy Duty Special 2* is the new, lithium-base grease that can be used for chassis, wheel bearings, water pumps and other bearing lubrication.

MORE THAN 625 MILLION POUNDS OF TEXACO MARFAK HAVE BEEN SOLD

For crawler mechanisms, use *Texaco Track Roll Lubricant*. It protects against wear and rust, prolongs roll life. For transmissions and differentials, use *Texaco Universal Gear Lubricant EP*—assure smoother performance, lower maintenance costs.

Let a Texaco Lubrication Engineer help you keep work on schedule through effective lubrication. Just call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write The Texas Company, 135 East 42nd Street, New York 17, N. Y.

Lubricants and Fuels

FOR ALL CONTRACTORS' EQUIPMENT

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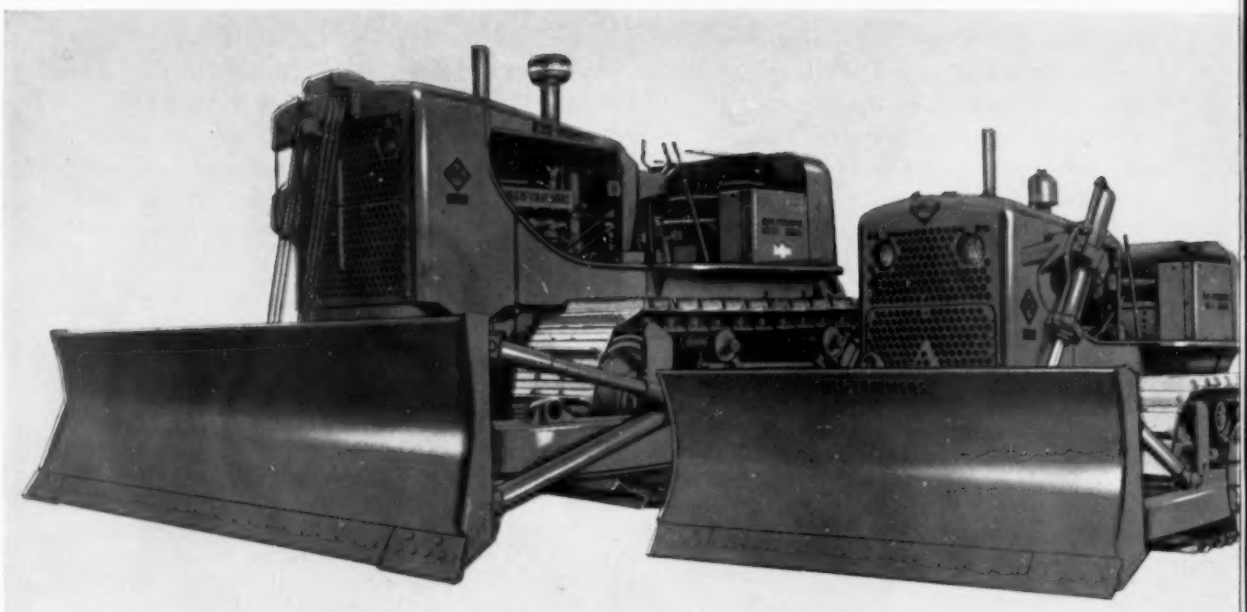
Here's why Allis-Chalmers higher rate of production -



HD-21
204 net engine hp (torque converter drive)
approx. wt (as illustrated) 53,400 lb

HD-11
85 belt hp
approx. wt (as illustrated) 24,600 lb

Advanced basic design makes the difference; look at these specific on-the-job advantages:

All-Steel Backbone for long tractor life. Exclusive box-A main frame absorbs shock loads, protects entire power train.

One-Piece Housing for steering clutches and final drives. It's strong, rigid, to resist twists and shocks . . . line-bored to maintain accurate gear and bearing alignment.

Rugged Final Drives — Small-diameter, double-reduction gears and short, thick shafts are tailor-made for today's bigger loads. Straddle mounting assures proper gear support, eliminates corner loading.

Tough Track — New heat-treating methods mean extra strength, hardness, wearability, long life even under severe conditions.

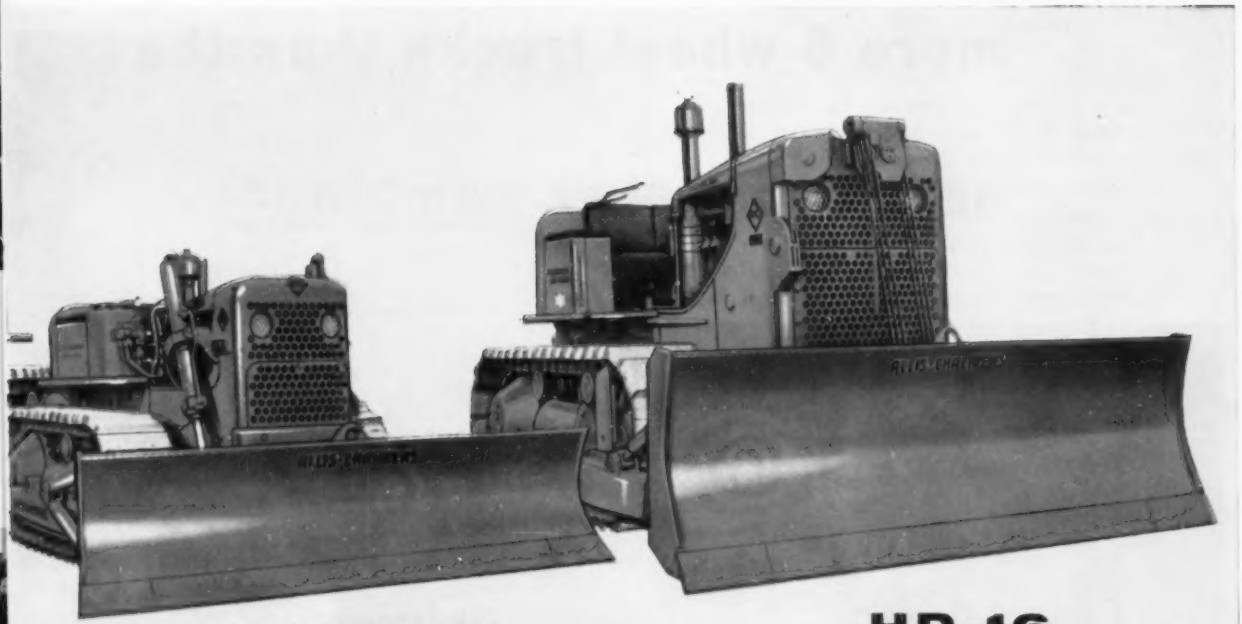
Saved Lubrication Time — On Allis-Chalmers tractors, you grease truck wheels, idlers and support rollers only once every 1,000 hours under any operating conditions—eliminate daily greasing — convert maintenance time into production time.

All-Weather Cooling Capacity — Big, well-protected radiators and cooling systems assure top efficiency and dependability in desert heat or arctic cold.

Wrap-Around Radiator Guard — Built-in dozer mounting reduces cost and weight, produces superior balance of tractor-dozer combination.

Longer-Wearing Master Clutches — Ceramic button lining (on all standard trans-

Crawler Tractors give you a - more working time – lower costs



HD-6
55 belt hp
approx. wt (as illustrated) 15,850 lb

HD-16
150 net engine hp (torque converter drive)
141 belt hp (standard transmission)
approx. wt (as illustrated) 38,200 lb

mission models) keeps clutches operating longer between adjustments, saves you time and money.

Smooth Torque Converter Drive — (standard on HD-21, optional on HD-16) — Automatically matches speed and power to load and terrain conditions, virtually eliminates shifting, assures steady, high output.

Matchless Servicing Accessibility — Unit construction permits easy servicing in the shop or on the job — quick removal of clutches, transmission, engine without disturbing adjacent assemblies.

Matched Equipment For Bigger Payloads — Fast-acting hydraulic or cable bulldozers, heavy-duty rippers, smooth-loading four-wheel scrapers make full use of Allis-Chalmers tractor advantages. You can also choose from a full line of tractor shovels from 1½- to 4-yd capacity.

The entire service program of Allis-Chalmers dealers is built around your needs. His factory-trained servicemen and all his facilities are designed to give you prompt and dependable service. What's more, he stocks only True Original Parts to assure you continued top performance and long equipment life. You owe it to yourself to see these new tractors at work. See your Allis-Chalmers construction machinery dealer soon.

ALLIS-CHALMERS, CONSTRUCTION MACHINERY DIVISION
MILWAUKEE 1, WISCONSIN

ALLIS-CHALMERS

. . . for more details circle 178, page 16

INTERNATIONAL sells more 6-wheel trucks than the next two makes combined!

And this kind of sales leadership has been going on every year for the past 21 years! One big reason: Actual cost records of the professional fleet operators—the men who *know* truck costs—prove these trucks cost less to own. Let your INTERNATIONAL Branch or Dealer show you in black and white, today. INTERNATIONAL HARVESTER COMPANY, Chicago.

INTERNATIONAL® TRUCKS

FIRST with men who know truck costs!

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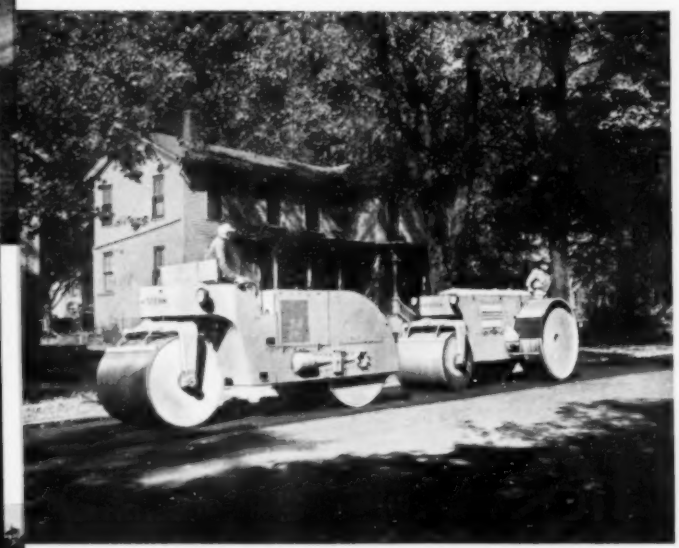
AUSTIN-WESTERN ROAD ROLLERS

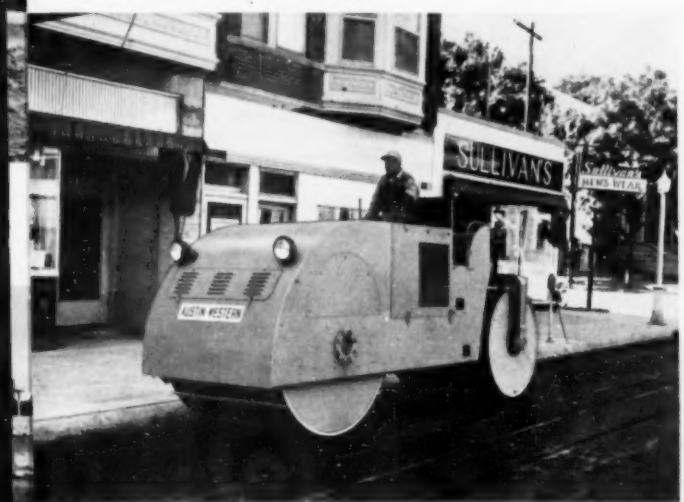
Engineered for Precision Operation and Trouble-free Performance



In this new series of Rollers . . . by America's first builder of motor rollers . . . all that is latest and best in engineering techniques and skills is combined with highest standards of construction to produce a truly fine product. With gasoline or diesel engines . . . dry clutch or torque converter drives . . . two-speed or four-speed transmissions, and drum-type front and rear rolls for water or sand ballast, these Rollers perform in a manner that will satisfy the most critical owner or operator . . . engineer or inspector. Your nearby A-W distributor will be glad to tell you the whole story. Austin-Western Works, Construction Equipment Division, Baldwin-Lima-Hamilton Corporation, Aurora, Illinois.

Engines, clutches, torque converters, brakes, hydraulic system units, bearings, seals and more than 75% of all other parts are interchangeable on Tandem and 3-Wheeled Rollers . . . an important service and repair advantage for the man who owns both types.

COMPLETELY NEW



Tandem Rollers range in weight from 5 to 14 tons. Each is available with gasoline or diesel engine, and optional torque converter drive.

3-Wheeled Rollers range in weight from 7 to 14 tons. Each may be had with gasoline or diesel engine, and optional torque converter drive.

Power Graders • Motor Sweepers • Road Rollers • Hydraulic Cranes

BALDWIN BLH LIMA-HAMILTON

AUSTIN-WESTERN WORKS

BALDWIN-LIMA-HAMILTON

Construction Equipment Division

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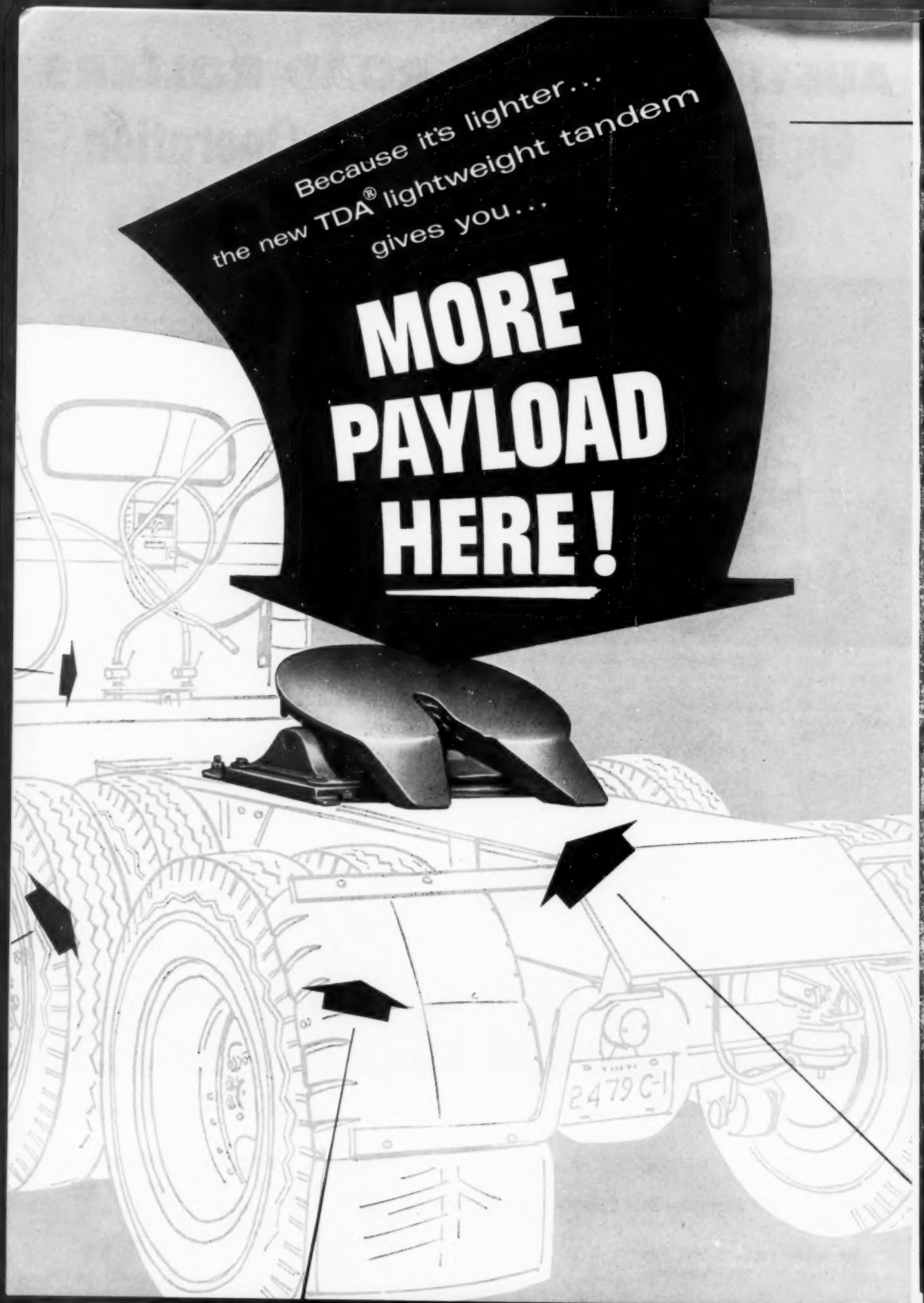
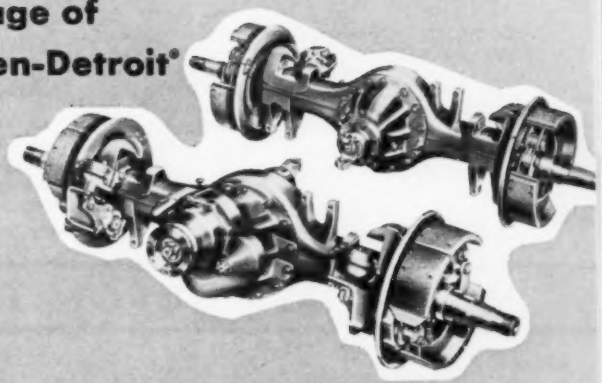

Because it's lighter...
the new TDA® lightweight tandem
gives you...
MORE
PAYLOAD
HERE!

this means . . .

8,500 EXTRA TON-MILES PAYLOAD A YEAR

. . . and it's built with a high percentage of parts interchangeable with Timken-Detroit® standard single axle components



There are important *payload bonuses* for truckers in TDA's new lightweight tandem. Over 230 pounds lighter than any unit of the same capacity, this new axle assembly gives operators more than 8500 extra ton-miles of payload during an average 75,000-mile trucking year.

Important *maintenance advantages* also are gained with this new tandem. Almost all of the wearing parts—gears, pinions, differentials, bearings and brakes—are identical with components from widely used TDA standard single axles. This means easier service, smaller parts inventory, and more time on the road.

Some Outstanding Features of this New Timken® Tandem

TDA Inter-Axle Differential divides torque evenly between axles . . . yet permits wheels of one axle to revolve faster or slower than wheels of the other axle. This means both axles are doing equal amounts of work . . . driving parts and tires last longer.

Driver-Controlled Lockout—with TDA Inter-Axle Differential, the driver can obtain the advantages of straight-through drive under slick or icy conditions by locking out the differential at any driving speed.

Big, Dependable Hypoid Gears rotate in conventional direction for maximum gear and bearing life.

Optional Axle Connecting Groups. This new tandem is available with either TDA famous "Cradle Ride" axle connecting parts, or brackets to accept other approved chassis hook-ups.

This new tandem insures new payload profits, faster, easier service and operating economies for operators everywhere. For complete information contact your nearest vehicle dealer or branch.

TIMKEN Detroit AXLES
TIMKEN-DETROIT AXLE DIVISION
ROCKWELL SPRING AND AXLE COMPANY
DETROIT 32, MICHIGAN
The Accepted D A Standard
TRADE MARK REGISTERED

WORLD'S LARGEST MANUFACTURER OF AXLES FOR TRUCKS, BUSES AND TRAILERS

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Plants at: Detroit, Michigan • Oshkosh, Wisconsin • Utica, New York • Ashtabula, Kenton and Newark, Ohio • New Castle, Pennsylvania

WHAT'S NEW in Equipment and Materials

Pneumatic Roller

A self-propelled, 11-wheel pneumatic roller has been introduced by the W. E. Grace Manufacturing Co., 6007 S. Lamar St. Dallas, Tex. The roller is powered by a 6-cylinder 48 hp Continental engine. Ten wheels have brakes and there is plenty of capacity for ballast being top-heavy.

Oscillation is provided on 10 wheels to give even compaction and to develop soft spots in the surface to be compacted that would otherwise be bridged over.

All tires can be changed without disturbing other tires. All six wheels at the engine end of the roller are driving wheels. Differential action is provided on each pair of outside driving wheels, and the center pair are driven directly.

Four speeds forward and four reverse are provided. All are nearly equal, giving speeds from 3 to 15 mph. Hydraulic steering is provided.

For more information circle 101 on Service Coupon this page and mail now.

Completely Power-Operated Wagon Drill

A completely power-operated wagon drill has been announced by Joy Manufacturing Co., Oliver Bldg., Pittsburgh 22, Pa. Called the Jr. Challenger, it is a self-propelled, track-mounted drill that mounts a 360 lb., 4½ in. drifter, drills up to 3½ in. diameter holes to depths of 40 ft., in any formation.

All movements of feed and drill are performed hydraulically (no chuck wrench necessary). Tramming power is provided by two air motors (one for each tread), which are direct-connected, thus eliminating drive chains. Each tread moves up or down independently to conform with terrain, then is locked simply by turning a valve, which provides absolute stability while drilling. The Jr. Challenger drills at any angle: vertical bench holes, toe holes, horizontal holes to 7½ ft. height, and angle holes both up and down from the horizontal.

For more information circle 102 on Service Coupon this page and mail now.

Single-Stage Torque Converter

A new line of single-stage torque converters has been announced by Twin Disc Clutch Hydraulic Division, Rockford, Ill. Currently available in the 1500 Series, they are the first of a new line of single-stage units.

The 1500 Series torque converters are for engines producing from 30 hp at 1150 rpm and 198 hp at 2400 rpm.

Specific torque ratings are 165, 200, 240, 285 and 330 lb.-ft., depending upon the impeller blading selected by the user.

The new Twin Disc unit features "unloading" of the engine through an exclusive blade design wherein the turbine develops a counter-head which stops fluid circulation at high speed ratios.

Another important design feature is that impellers having different bladings (both number of blades and pitch) are interchangeable. Thus the converter's torque capacities can be matched as accurately as possible to engines of various hp outputs and speeds, within rated limits, without requiring changes in the converter housing or other components.

For more information circle 103 on Service Coupon this page and mail now.

Heavy Duty Ripper Fits Largest Tractors

A special new heavy duty ripper, announced by Hensley Equipment Co., Inc., 800 Peralta Ave., San Leandro, Calif., is designed to fit D-9 tractors, and others of comparable size and horsepower.

Chief feature claimed for the new Model 2000-H ripper, is its outstanding wearing quality. Due to a specially designed wear collar, which provides added protection to the leading edge of the ripper shank, Model 2000-H gives maximum wear over longer periods.

The Model 2000-H ripper is fully adjustable and interchangeable on D-8, D-9, HD-19, HD-20, TD-24 and other tractors with blade heights varying from 39 in. to 61 in.

For more information circle 104 on Service Coupon this page and mail now.

More equipment news page 154

LPG Now Adoptable to Jeep Engines

LPG and natural gas conversions of 'Jeep' L-Head and F-Head industrial engines are now available as optional equipment according to an announcement by Willys Motors, Inc., Industrial Engine Department, Toledo, O. The 'Jeep' engines' ability to give dependable service with either of the conversions is backed by Willys' standard warranty.

For more information circle 105 on Service Coupon this page and mail now.

Truck Rims Protected from Corrosion

A new and exclusive treatment of truck rims that gives overall protection against corrosion from water, road salts and abrasion has been developed by the Firestone Steel Products Co., Akron, O. The new perma-plating process has been adopted by the company after more than three years of laboratory experimentation with epoxy resins.

For more information circle 106 on Service Coupon this page and mail now.

For more items . . . . see page 154

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22 West Maple Street
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Stronger front axle, heavier chassis, more rugged power train—the new International 300 Utility leads the field with up to *1,000 pounds greater built-in weight* than other make utility tractors. The result is more stamina, *plus* better tractor balance for work with rear-mounted fork lift, greater traction for dozing, and more rugged strength to stand up under heavy-duty loading operation with a half-yard bucket. Big tires let you lift or load, pull or push equally well on paved or unpaved areas.

10 speeds forward with optional Torque Amplifier, from 1.5 to 16.8 mph . . . change speed, increase pull-power *on the go* for timesaving fork lift operation—handling loads up to 4,000 pounds.

Endless utility! You can equip the 300 Utility with rear-mounted fork lift alone, or use combinations of equipment such as heavy-duty front loader and rear blade (above). For seasonal or special needs, you can change to dozer blade, trench hoe, crane, snow plow, sweeper, mower, drag scraper, hole digger, and other equipment to cut your job costs.

Your International Industrial Power Distributor will demonstrate! Phone today for an on-the-job test. Nearly 50 items of special-duty equipment let you match 300 Utility to your job *exactly*. For free folder, write International Harvester Co., 180 N. Michigan Ave., Chicago 1, Ill.

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. . . for more details circle 242, page 16

ALL-WELDED BOOM with Gooseneck Design for Deep Digging

FAST on the Job...EASY to Handle!

Added to the UNIT line of proven equipment, is the New UNIT CHALLENGER. Here's a modern 3/8-yard machine that provides a perfect combination of design and construction. Packed with new advanced engineering features: **Self-aligning Hook Shoes... Force Feed Lubrication . . . Full Floating Trunnion-Mounted Tapered Drums . . . Torque Converter,** etc., the New UNIT CHALLENGER is the most dependable machine that money can buy.

Bulletin C-800 completely describes and illustrates the New UNIT CHALLENGER.

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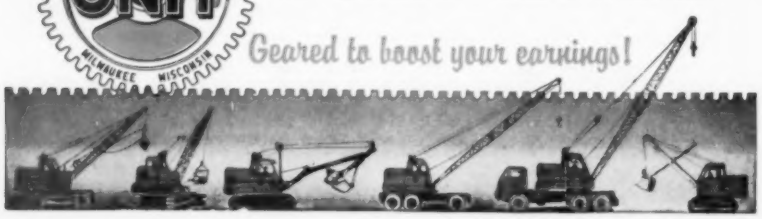

. . . for more details circle 297, page 16

Poor Foundation Blamed for Runway Defects

Neglect of maintenance and need for heavier designs also cited by asphalt industry leaders in challenging Air Force policy.

Statement by Arvin S. Welborn
Chief Engineer, The Asphalt Institute

THE decision of the Air Force to curtail construction of asphalt pavements on military airfields was based on alleged pavement failure at seven heavy bomber bases, two of these in California, two in Arizona, two in Oklahoma and one in Florida.

With the permission of the Department of Defense, these bases have been inspected by engineers of The Asphalt Institute. Preliminary appraisal of the inspection reports indicates that, in every instance, pavement distress was caused by the displacement of supporting foundation materials. The reports also show:

- Air Force criticism of asphalt pavement has been unduly harsh.
- Serious pavement distress was found at only two of the seven bases in question.
- Pavement maintenance at these military airfields continues to be haphazard or seriously neglected, and
- There is a definite need for heavier airfield pavement design and improved construction methods to accommodate America's heavy bombers.

The reports, covering inspections made at all seven bases, included these preliminary findings:

None of the four bases in California and Arizona showed a condition of pavement distress serious enough to impede normal operational activities.

At one of the two bases in Oklahoma the reports showed evidence of serious rutting which could be traced directly to displacement of foundation materials beneath the pavement. At the other Oklahoma base, heavier aircraft have not been operated extensively on the pavement and, of course, there is no evidence of distress.

The seventh base, in Florida, has developed dips in the pavement at

(Continued on page 22)

ROADS AND STREETS
Sixty-Four Years of Editorial Leadership

Washington News Letter

By Duane L. Cronk

June 10, 1956

The Senate last month passed its version of a bill creating a National Highway Program and appointed its top highway authorities to confer with members of the House over differences in the two measures. By the time this is read, it is quite possible that all disagreements will have been compromised and the final draft signed into law by President Eisenhower.

Under the masterful guidance of Senator Albert Gore, chairman of the Roads Subcommittee, the Senate see-sawed through a series of controversial provisions contained in a bill authored by the Tennessean and approved by the powerful Public Works Committee. When the bill was read for the third and final time, after 14 hours of debate on the second day, the Senators shouted their approval. If there were any "nays," they were lost in the rush for the exits.

Within two days, the Senators had delved into some of the basic concepts of federal-state relationships in the highway area, and settled to majority satisfaction what kind of program they believed would most effectively reconstruct the nation's highway system.

Some of the strongest political considerations forced their imprint on the bill. But for the most part, the Senators wrote a constructive long-range plan for road construction, and endorsed the financing scheme written by the House. It was perfectly apparent that on the floor some of the most learned men in America on the subject of highway administration and finance were laboring in the cause.

* * *

It was widely predicted that election-year realities would dictate the inclusion of a provision in the final bill requiring contractors to pay area prevailing wages, as determined by the federal government. Although their cause was practically smothered in the House, the Senate took a more understanding view of the contractors' opposition.

Aware of the hardship which Davis-Bacon rules might have on some contractors and some states, a block of Senators sought to soften the blow by four counter attacks: Senator Capehart of Indiana urged that the state highway departments be permitted to determine the area prevailing wage rates. The move failed . . . . Senator Chavez proposed that the Secretary of Labor be required to seek the counsel of state highway officials in determining the area wage rate. This modification was adopted . . . Senator Case of South Dakota asked that the Secretary of Labor be required to make a "predetermination" of wages and that they be included in the advertisement for bids, so that contractors would know what the wage rates would

(continued on next page)

be before bidding. This compromise was accepted . . . Senator Fulbright of Arkansas asked for a provision which would permit judicial review of any wage rate determination by the Secretary of Labor. The amendment carried.

No one is optimistic about the chances of the more moderate Senate labor provisions prevailing in conference. But, as one of the Senators said, "We've got something to bargain with, at least."

* * *

The second major area of disagreement with the House was in the formula by which funds would be apportioned to the states for construction of the National Interstate System. The House was determined that the $25 billion authorized for the System should be distributed on the basis of what each state would need to complete its mileage. The Senators, refusing to place any faith in the estimates of "need" submitted by the Bureau of Public Roads, called for distribution on a formula drafted in 1954 - namely, two-thirds on the basis of population, one-sixth on rural post road mileage, and one-sixth on area.

It was pointed out that cutting the pie that way would give some states two and three times as much money as they would need to construct the System within their borders, and that other states would receive less than enough. Feelings ran high as more than one Senator spoke to the point. Senator Capehart of Indiana declared:

"This is just a lot of pork barrel . . . Many of the states under this formula will get a great deal more money than it will cost them to build the Interstate System. They will take 20% of it, as the bill permits, and put it into their primary and secondary roads instead. I believe the real purpose behind this formula is to provide some pork barrel money. That is what I say."

* * *

Those who decried apportionment on the basis of need did so because, they declared, the Bureau of Public Road estimate is completely unreliable. It has been known for months that some states did not use Interstate System engineering standards in determining costs, did not include (or grossly under-estimated) urban costs, and otherwise failed to report their needs realistically. Every highway organization that testified on the subject in the hearings had appealed for apportionment of the Interstate funds on the basis of need. But when it came to a showdown, the Senators who supported that view, unfortunately, didn't have a statistical leg to stand on. As Senator Kerr of Oklahoma told them:

"This tabulation (of the states' estimates) has neither pride of ancestry nor hope of posterity. It does not have the approval of the Bureau of Public Roads. It does not have the sanction of the Department of Commerce . . . I have never seen a greater effort by a public bureau . . . to disclaim any responsibility for a document . . . We are asked to make a guess the basis for a definite allocation."

Between these two opposing views is plenty of latitude for compromise in conference. It would not materially harm the program, many are saying, to follow the Senate formula for two years and then shift to a basis of true need, as established by another, more reliable BPR survey.

After spreading topsoil along over-pass shoulders in accurate 2" layer, rig swings around in tight 180° turn in less than its own 28' length. Big rubber tires roll over new concrete highway without damaging its surface.

Accurate 2" spread

speeds Indiana Toll Road finishing

28 mph D Tournapull hauls heaped 5-yd. load of topsoil from stockpile to spread in 2" deep layer along shoulders, slopes and median strip on 14-mi. section of Indiana Toll Road.

Push-loaded "D" heaps 5-yd. load in 58 seconds, completes 6200' round trip in 6½ minutes.

With 1,000,000 square yards of 2" deep topsoil to move and spread on a 14-mile section of the Indiana Toll Road, Smith Bros. Excavating, Cassopolis, Michigan, assigned all dirtmoving to their two 138 hp D Tournapulls. Smith subcontracted from Western Contracting Company of Sioux City, Iowa, to haul and spread topsoil on shoulders, slopes and median strip of the turnpike.

"D's" load in 58 seconds

On this part of the Indiana Toll Road, Smith's D Tournapulls were working on an overpass road near White Bristol, Indiana. Here, machines were push-loaded in topsoil stockpiles by an 85 hp crawler-tractor. "D's" each scooped 5-yd. loads of the material in about 58 seconds. Although 1000' of the haul road was adverse grade, each "D" completed a 6200' round trip in 6½ minutes. Rigs' fast 28 mph speeds paid off for owners in more trips, more output per work-hour.

"D" crosses pavement . . . turns within 26'

Tournapulls safely traveled across completed concrete road where other machines would not be allowed to travel. Big, low-pressure rubber tires easily rolled over new concrete slabs without damaging surface.

Versatile D Tournapulls often worked in tight corners and in traffic, where other self-propelled scrapers couldn't possibly go. They turned around in a space only 26' wide . . . even less than their 28' overall length. The "D's" short 90° turning angle speeds all their work cycles . . . let machines move faster *on* and *to* the job.

Valuable job handler

For an all-around utility tool to handle your dirtmoving assignments quickly and easily, check into the performance facts and figures on D Tournapulls. There are larger Tournapulls available to handle your heavy production jobs. Call or write for more information on these highly-maneuverable, productive machines.

Tournapull—Trademark Reg. U.S. Pat. Off. DP-951-H-b

LeTourneau-WESTINGHOUSE Company

Peoria, Illinois

A Subsidiary of Westinghouse Air Brake Company

. . . for more details circle 252, page 16

SONOVOIDS®
reduce weight and cost of bridge deck!

Highway Overpass, near Kansas City, Kan. State Highway Commission of Kansas, Bridge Dept., designers. L. G. Barnes & Sons, contractors

SONOVOID®
FIBRE TUBES
for voids in concrete construction

The Bridge Department of the State Highway Commission of Kansas designed this Overpass for economical construction!

Low-cost SONOVOIDS were used to form voids in the bridge deck in order to reduce weight and save concrete and reinforcing steel . . . and low-cost SONOTUBES were used as formwork for the piers!

SONOVOID Fibre Tubes eliminate dead weight by the displacement of concrete below the neutral axis . . . without impairing structural strength.

Use SONOVOIDS in concrete bridge deck, wall, floor and roof slabs and in forming hollow piles . . prestressed and poststressed precast units or units cast in place.

Supplied in specified lengths up to 50' long or can be sawed to your requirements on the job Sizes 2.25" to 36.9" O.D. End closures available. Order SONOVOIDS for your next job!

For complete technical data and prices, write

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. . . for more details circle 283, page 16

Runway Defects

(Continued from page 18)

approximate 100-foot intervals along the centerline of the runway, causing the aircraft to "porpoise" at high speed. Again the fault is clearly in the foundation.

In every instance, the Institute inspections confirmed the findings of a special committee of the Highway Research Board which, at the request of the Department of Defense, made an extensive study last year of pavement conditions at 27 major military airfields. On that occasion, the committee reported a serious lack of proper airfield maintenance at virtually all installations. The reports of the engineers of The Asphalt Institute find this condition still existing.

The reports pointed up one disquieting feature that suggests a revision of airfield pavement design may be in order. Present design criteria are based on the assumption that aircraft movements will be distributed over the entire width of taxiways and runways. However, heavy bomber traffic, instead of being so distributed, is channelized along the centerline. A rising volume of traffic and steadily increasing wheel loads, coupled with this channelization, has established a pattern of pavement stress which calls for heavier pavement design to carry this narrow concentration of loading. This channelization of heavy wheel loads is resulting in accelerated attrition of all airfield pavements, regardless of type.

The reports indicate there is a definite need, not only for heavier design, but also for better construction methods for all heavy bomber airfield paving, with particular attention to the need for better foundations and proper drainage.

With necessary attention to these requirements, there is not the slightest doubt that asphalt pavements will meet all airfield runway and taxiway needs, and do the job at tremendous savings to the taxpayer.

• The Maryland governor has signed a bill (S. 110) to streamline the right-of-way acquisition procedure. Under the new law, after plats are made and recorded showing the center line of proposed construction, the fair market value of each property taken is determined and payment is either made to the owner or the Circuit Court, and possession may be had and construction begun. The law provides for creation of a Board of property review in each county to settle grievances of dissatisfied landowners.

Four-wheel drive, and tires 2' wide, give Tournatractor ample traction to make full use of its 208 hp.

Root-Rakes

Here's what high-speed on rubber can do for you

Tournatractor, with 17 mph forward speed and 8 mph reverse speed, can do many tractor jobs twice as fast as a crawler-tractor.

Drives anywhere

Because of its big low-pressure tires, Tournatractor drives anywhere under its own power. Job-to-job moves can be made across pavement, over curbs, sidewalks, and railroad tracks. On long moves it saves time, bother, and expense of locating a trailer, moving in extra manpower and transport equipment, loading and unloading.

Reduces maintenance

Tournatractor greatly reduces maintenance and service costs by eliminating some 500 wearing parts that grind through dirt in a crawler-track assembly. Eliminated also is the friction caused by grit-grinding in the track assembly which reduces rated horsepower.

Easy to operate

With simple, easy-to-handle, power controls, and comfortable, adjustable, foam-rubber seat, operator on Tournatractor works comfortably, with less fatigue, maneuvers faster, gets more work done, in less time, with less effort.

High-speed performance

Constant-mesh transmission eliminates delays in changing gears... saves vital momentum... gives any gear-ratio instantly. As a pusher or dozer, Tournatractor high-speed reverse (up to 8 mph) is a very important time saver.

Versatility helps get more work done

Wide range of attachments increase Tournatractor range of applications, extend length of work season. Since Tournatractor is a "traveling man", these optional attachments are especially important in finding profitable jobs in a wide range of big or small industries and in any climate or area selected.

a. Equipped with Bulldozer or Angledozer blade, Tournatractor push-loads scrapers, moves short-haul dirt, cleans up at shovel, loads and spreads on dump, digs drainage ditches, maintains haul roads, clears land, terraces, digs stock piles, grades roads. Does all these jobs fast.

b. Root-Rake makes 208 hp Tournatractor a powerful tool for clearing brush, grubbing roots, raking out boulders, etc. The 11'4" wide x 4'6" high rake has 10 teeth of 4" high-grade steel, to resist shock, do heavy work.

c. Tree-pusher attached to Tournatractor, reaches high on tree with 32' forked boom, provides extra leverage to push trees down fast. Boom angle creates down-pressure on tires, increases traction, helps remove more trees in less time.

d. Tournatractor with drawbar attachments does wide variety of chores—keeps working at 100% availability. Pulls scrapers, sheepsfoot rollers, rooters, and other drawn equipment.

Ask for owner-verified job reports on work similar to yours.

Tree-pusher

Tournatractor, Angledozer, Rooter—Trademark Reg. U.S. Pat. Off. T-954-G-bw

LeTourneau-WESTINGHOUSE Company

Peoria, Illinois

A Subsidiary of Westinghouse Air Brake Company

. . . for more details circle 253, page 16

20th ANNIVERSARY
SOIL-CEMENT
PAVING

South Carolina Rte. 41 near Johnsonville, the first scientifically-controlled soil-cement road.

A new soil-cement road in Riverside County, California.

Proved in service coast to coast...

SOIL-CEMENT

Twenty years ago engineers built America's first scientifically-controlled soil-cement road in South Carolina. This low-cost road today carries much greater traffic yet requires only routine maintenance.

One of the newest soil-cement projects is the California highway at the left. In 20 years soil-cement paving has spread from coast to coast and proved itself under all climatic conditions. Today there are more than 10,000 miles of soil-cement roads delivering dependable, all-weather service.

This 20-year record of service has amply proved the value of soil-cement—the economical pavement made from local materials mixed with portland cement and water. About 85% of the required material usually is soil already on the site. Only cement and water must be hauled to the job.

For more information about soil-cement paving for low-cost roads, streets, and airports, write for free literature. It is distributed only in the United States and Canada.

PORTLAND CEMENT ASSOCIATION

Dept. 6-28, 33 W. Grand Ave., Chicago 10, Ill.

A national organization to improve and extend the uses of portland cement and concrete through scientific research and engineering field work

. . . for more details circle 275, page 16

Wide bowl-opening on Rear-Dump provides easy entry, big target for shovel, dragline, or conveyor loader. Units come in 11, 22, and 35-ton capacities.

Smooth, streamlined, unobstructed body dumping at 66° angle readily sheds sticky material.

Hauls to overburden dump are made at speeds up to 32 mph by this C Rear-Dump.

Big-tire haulers beat mud problem

A Canadian company had the problem of stripping 30 to 75-ft. layer of wet clay out of rock pockets. Soft and sticky with trapped-in moisture, this overburden was loaded by draglines, and hauled half a mile to waste dumps. Four C Tournapull Rear-Dumps were used to speed hauling.

Exceptional mud-ability

As owners everywhere have found, Tournapull Rear-Dumps go through mud which stops conventional truck-type haulers. On this overburden job, for example, these Rear-Dumps worked out of deep mud-holes in the pit and off dumps so soft a man could not walk through them. The exceptional mud-ability they showed is due partly to traction of big 21.00 x 25 low-pressure tires . . . partly to electric power-steer through geared kingpin which "walks" Tournapulls out of trouble . . . partly to exclusive differential which *automatically* transfers power from slipping wheel to wheel on firmer footing.

On rough haul-roads, Rear-Dumps with 5'6" diameter tires haul faster than trucks. The big tires grip and roll over the bumps, cushion machinery and operator from road shocks.

Turn around non-stop

These Rear-Dumps also work faster and with greater safety in narrow quarters than conventional haulers. They turn around in much less space. When bowl is raised, they shorten wheel-base to turn non-stop in an area about 1/3 less their overall length. This maneuverability speeds haul on narrow roads, reduces spotting time at shovel and dumps.

Dump fast and clean

Practically no clean-up is needed on the dump. With front-wheel drive, Rear-Dumps back safely to edge of bank. Bowl swings behind and below rear wheels . . . loads fall free and clear over the edge, with little spillage, seldom call for clean-up.

Ask your LeTourneau-Westinghouse Distributor to show you first-hand how Rear-Dump advantages can pay off on your work.

Rear-Dumps now available with optional tailgate.

Tournapull—Trademark Reg. U.S. Pat. Off. R-982-G-bw

LeTourneau-WESTINGHOUSE Company

Peoria, Illinois

A Subsidiary of Westinghouse Air Brake Company

. . . for more details circle 254, page 16

for l-o-ong range economy . . .

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the cold-applied paving joint sealer

COSTS LESS OVER THE YEARS, because it:

Remains Flexible, Resilient and Adhesive.

Retains its tough elasticity from sub-zero through 140°F. temperatures . . . won't squeeze out in hot weather to leave an exposed joint in cold weather.

Is Convenient, Easy to Apply.

No mixing or proportioning, use direct from drum. Saves man-hours, expensive and elaborate equipment.

. . . for a lasting investment — insist on PRESSTITE No. 77.

For Jet-Resistant Airfield Paving Joints...

PRESSTITE No. 99

the toughest, most economical sealer available: a two-component cold-applied sealer that resists jet blast-out, melting and blowout; shock and impact. Meets Federal Specifications SS-S-170.

PRESSTITE Sealing Compounds

PRESSTITE-KEYSTONE ENGINEERING PRODUCTS COMPANY

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A Division of AMERICAN-MARIETTA COMPANY
3738 Chouteau Avenue, St. Louis 10, Missouri • 101 East Ontario Street, Chicago 11, Illinois

. . . for more details circle 276, page 16

Traffic Safety

Special and oversize signs for Kansas Turnpike

The 236-mile Kansas Turnpike will have 325 types of special message signs, totalling 1,024 such signs, according to a statement by Gale Moss, Turnpike general manager. These signs which are in large block letters with arrows will be used mostly at interchanges to direct entry and exit traffic, and at service areas where traffic may halt for restaurants or filling station service. In addition, there will be several hundred other standard highway signs, with the messages painted in aluminum on a green background against porcelainized enamel. The letters will be cut out of sheet aluminum and finished with silver Scotchlite.

Bids were taken recently for the entire signing job which also will include about 21,000 three-inch reflectors or delineators to be used on curves, edges of small fills, at structures, guard rails, approaches to service areas, and on mile-post markers.

Two series of signs will be used on the turnpike. Type A signs are those under 49 sq. ft. in size, type B over 49 sq. ft., the latter being chiefly to designate names of interchanges, concession areas and exit points. The larger signs will usually consist of 7x15 ft. rectangles with block letters up to 12 in. height.

The turnpike sign colors and letters, selected after field tests, were chosen to permit fast-moving drivers to read directional or mileage messages clearly at 600 to 900 ft. distances for the larger signs, in time for proper reactions to the information given.

Traffic course at University of California

Designed for traffic engineers concerned with research, planning and signalization in cities, counties, and states, and for instructors of traffic engineering, a two-week course on Simulation and Theory of Traffic Flow has been planned for next fall on the Los Angeles campus of the University of California.

Planned by the UCLA Institute of Transportation and Traffic Engineering and the engineering division of University Extension, the course will be held Sept. 10 to 21. These dates

(Continued on page 28)

Four work speeds, 1.8 to 6.4 mph, provide the best power and speed for each particular job assignment.

Today's big news in motor graders

is the all-new 60 hp ADAMS "220"

Here is a low-priced grader with big capacity for hard work. Weighing 14,865 pounds, powered by a 60 hp diesel engine, "220" handles many jobs done by larger machines, saves you money on general grading and road maintenance. Big in value, Adams "220" out-works, out-maneuvers any grader in its size and price class.

Works like a big machine

Like the larger Adams machines, the "220" has 4 working speeds under 6.5 mph, and 4 optional "creeper" speeds for full use of engine power in slow, rugged, or precise work. Travels job-to-job up to 18.3 mph.

Blade controls are straight-line-thrust hydraulic. Moldboard swings from ditch-cut to 90° high bank-cut, on either side of grader, in less than a minute, without operator leaving cab. 10-ft. slide-shift moldboard has 6 pitch positions, and reaches 54½" outside wheels. Leaning front wheels, hydraulically operated, offset side thrust, make short turns possible. Wide tread (76" front, 77" rear) gives stability, safety, and easy handling on slopes.

Built like a big machine

"220's" big 10:00 x 24 tires on all six wheels give firm footing and minimum rolling resistance. Sturdy 4-wheel tandem-drive utilizes full engine power, provides push-power and traction for doing many of the heavier jobs. Rugged diesel engine is cranked electrically, starts quickly in all seasons.

Optional cab, open or enclosed type, has 6'4" inside height, floor to ceiling, without use of "foot wells".

Operator controls blade movement from cab, swings moldboard ditch-cut to 90° high bank-cut on either side of grader, in one continuous motion. Exclusive gear assembly multiplies hydraulic ram action, 3 to 1.

Sturdy one-piece, rectangular-welded-section frame, and strong Y-shape drawbar, withstand punishing shocks and stresses. Arched frame provides 17" blade clearance to clear shoulders when climbing out of ditch.

Anti-friction steering, and smooth, fast-acting hydraulic brakes give operator confidence to work or travel at highest practical speed.

Scarifier, power-shift moldboard, 12' moldboards, cab, and other accessories, available as optional equipment.

See Adams in action

We will be glad to prove to you that "220", as well as larger Adams graders, work harder, faster, and at lower cost than other graders of similar size and power. Why not call or write and ask for a competitive demonstration?

Model 220... 60 hp...14,865 lbs.
Model 330... 80 hp...20,500 lbs.
Model 440...104 hp...21,500 lbs.
Model 550...123 hp...23,500 lbs.
Model 660...150 hp...27,730 lbs.

AG-44-G-b

LeTourneau-WESTINGHOUSE Company

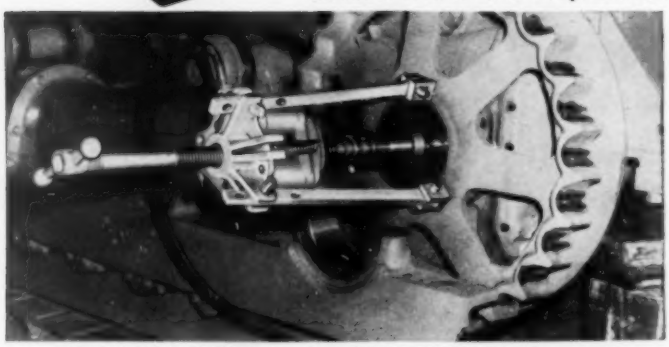
Peoria, Illinois

A Subsidiary of Westinghouse Air Brake Company

. . . for more details circle 255, page 16

Here's how to CUT DOWN-TIME with OTC hydraulic power units

Portable Pulling and Installing Units Save Time on Thousands of Jobs in Shop or Field

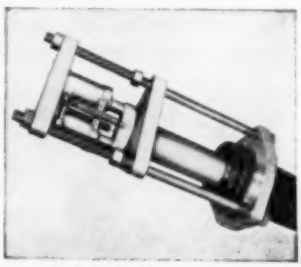


One of hundreds of jobs done easier and faster with OTC hydraulic pulling units. Here a 50 ton Power Twin unit is removing a crawler tractor sprocket.

OTC tools save time because they go to work fast—they fit the work and one man can set the pulling units in position in minutes. Then the powerful ram goes to work saving hours and sometimes days in repairing all types of field equipment.

OTC famous hydraulic tools offer up to 100 tons of power to instantly pull or install parts without distortion or breakage. For more than 20 years OTC tool designers have worked with factory service engineers building these tools to speed maintenance in shop or field. Sets are available for all makes of tractors and other equipment.

Whatever your special problem, let us help you. OTC manufactures the most complete line of pulling tools available. Start now to save time and money. Get acquainted with OTC.



OTC 50 ton unit—the only tool that can remove and install International TD 24 track and accumulator spring in the field.

OTC 100 ton Power Twin hydraulic unit removing pivot shaft from a TD 18 tractor.

SEND FOR NEW FREE HYDRAULIC BOOKLET

OWATONNA TOOL COMPANY

435 CEDAR STREET OWATONNA, MINNESOTA

. . . for more details circle 273, page 16

Traffic Safety

(Continued from page 26)

were selected to permit traffic engineers from distant points to attend on their way to the annual Institute of Traffic Engineers meeting in San Francisco the following week.

The Los Angeles course will serve as an introduction to computers, numerical methods, preparation of problems for a computer, mathematical models, probability, simulation techniques, evaluation of computer equipment and application of these techniques to traffic problems. Instruction will consist of lectures, laboratory periods and reading assignments. Fee for the study, limited to 40 students, will be $100.

An advisory committee appointed to assist in the planning of the course has as members, Joseph E. Havenner, vice-president of the Institute of Traffic Engineers (chairman); Lloyd M. Braff, city of Los Angeles; Edward M. Hall, San Diego transportation research project; Alexander L. Hutchinson, California division of highways; Guy D. McDonald, county of Los Angeles; and Daniel L. Gerlough, associate engineer with the UCLA ITTE.

Instructional staff for the course will be composed of members of the UCLA ITTE staff, authorities from other universities and research agencies, and practicing traffic engineers. A detailed syllabus is being prepared as a text during the course and as a reference book after it is completed.

Advance registration forms are obtainable by addressing requests to the Institute of Transportation and Traffic Engineering, University of California, Los Angeles 24, California.

County highway conference to draw 1200 delegates

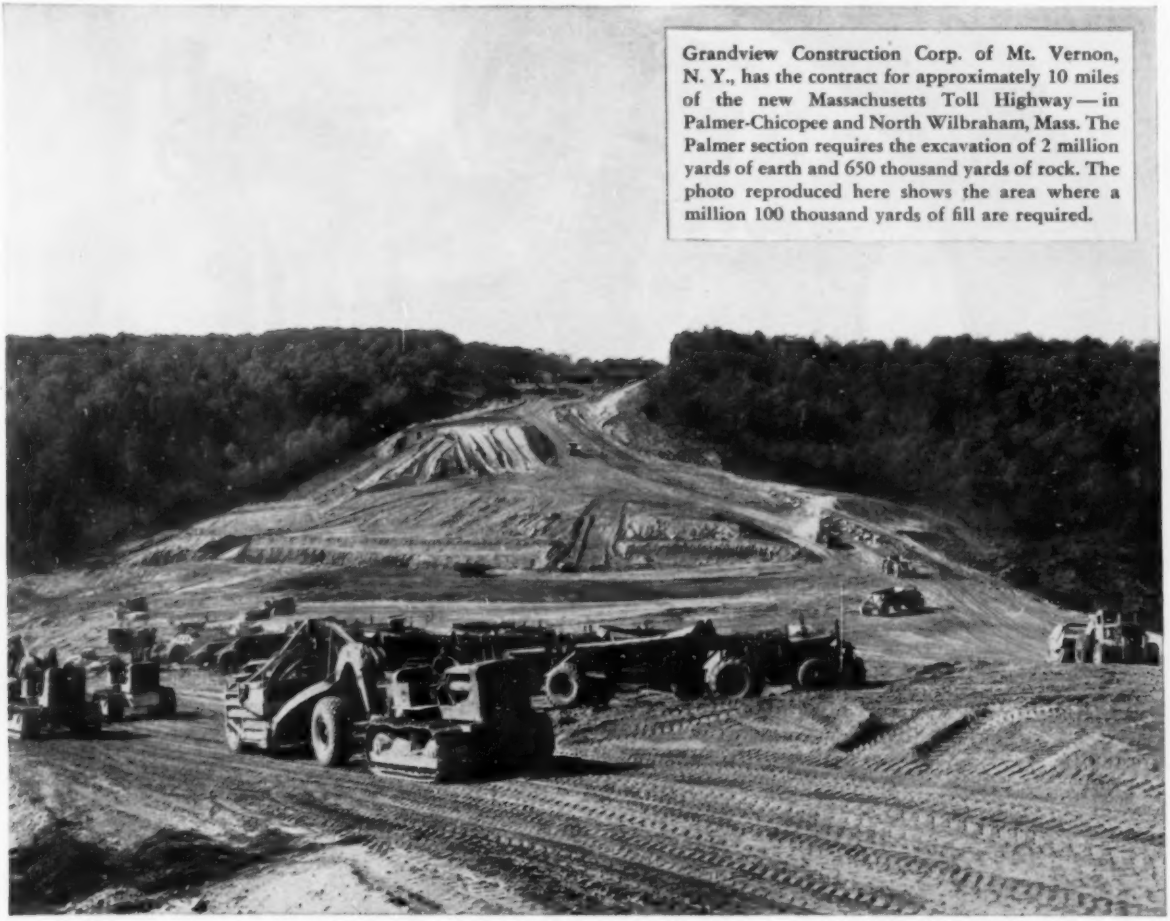
A record-breaking attendance of 1200 or more is anticipated for the 4th National Highway Conference, to be held this year at Mackinac Island in Upper Michigan. Conference is sponsored by the County and Local Roads Division of the American Road Builders Association.

According to Allan M. Williams, engineer of the Ionia County (Mich.) Road Commission and president of the division, committees are already at work planning for this conference. For further details, those interested should address Ben Ostergren, American Road Builders Association, World Center Building, Washington, D. C.

GULF PRODUCTS *and* FINE SERVICE

keep equipment rolling

on Massachusetts Toll Highway Project



Grandview Construction Corp. of Mt. Vernon, N. Y., has the contract for approximately 10 miles of the new Massachusetts Toll Highway — in Palmer-Chicopee and North Wilbraham, Mass. The Palmer section requires the excavation of 2 million yards of earth and 650 thousand yards of rock. The photo reproduced here shows the area where a million 100 thousand yards of fill are required.

LIKE other leading contractors, Grandview Construction Corp. is mighty careful about controllable costs, particularly maintenance expense.

And that's an important reason why the Grandview Construction people selected Gulf as their supplier of petroleum products on the Massachusetts Toll Highway Project. They have found that Gulf quality lubricants keep their maintenance costs at rock bottom levels . . . and they appreciate Gulf's prompt delivery service and helpful petroleum engineering counsel.

Send the coupon for your copy of our new brochure, "Gulf and Your Business."

GULF

Gulf Oil Corporation • Gulf Refining Company

1822 Gulf Building, Pittsburgh 30, Pa. R&S

Gentlemen:

Please send me a copy of your new brochure, "Gulf and Your Business."

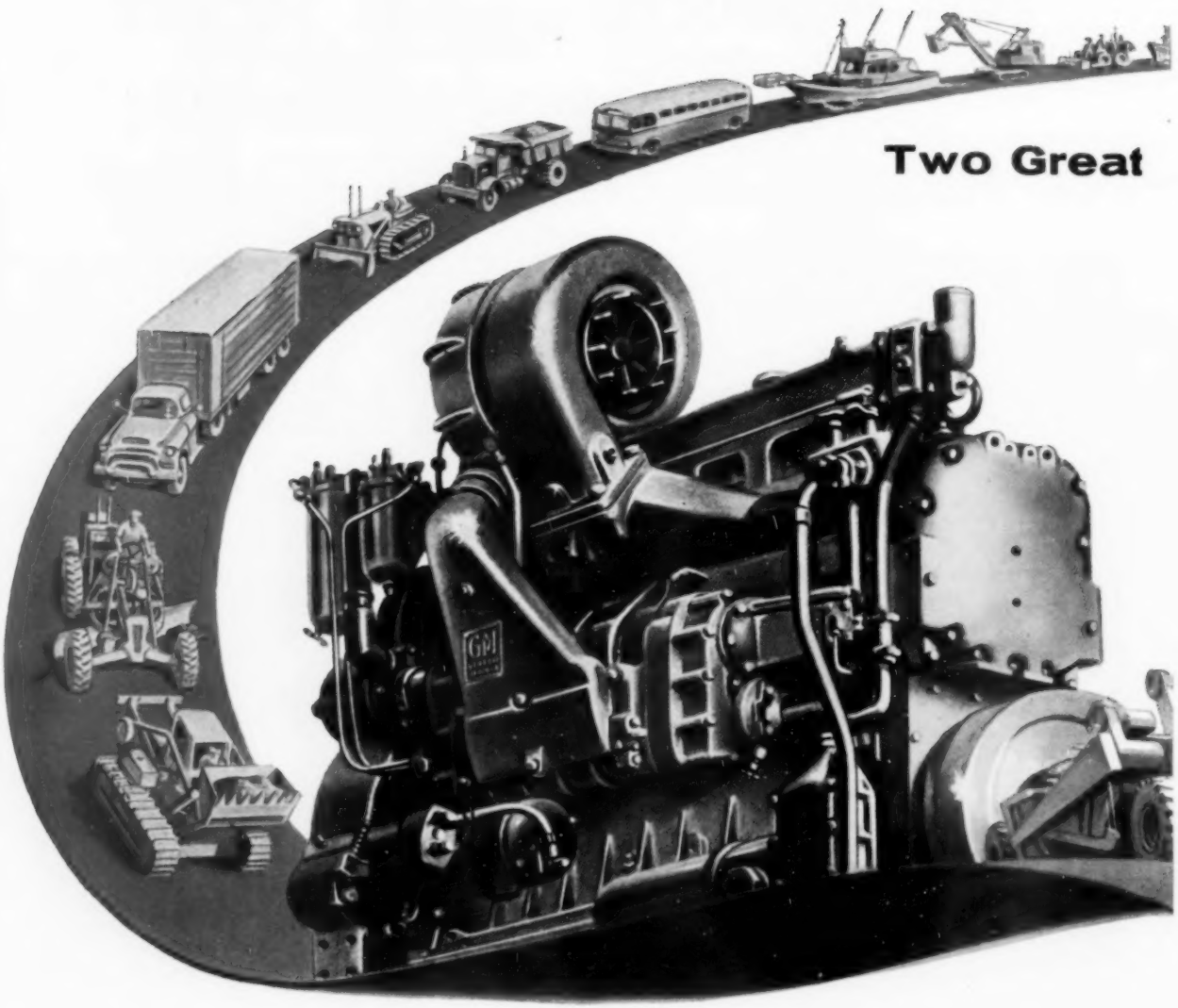
Name.....

Company.....

Title.....

Address.....

. . . for more details circle 231, page 16



Increased Power—Decreased Fuel

Here's exciting news for power users—great new 4- and 6-cylinder GM Detroit Diesel engines that represent another long forward step by the leader in the Diesel engine field. With this new, more efficient Detroit Diesel Turbopower you can have up to 17% more power with no increase in fuel consumption—or the same power output with fuel saving up to 15%.

Detroit Diesel engineers have Turbocharged 2-cycle Diesels by combining an exhaust-driven turbine with the engine blower to deliver a larger supply of fresh air to the cylinders. Result: improved combustion, freer engine breathing, quieter and more efficient performance in the higher speed ranges.

Turbopower Diesels are additions to Detroit Diesel's time-proved Series 71 line, world's most widely used Diesel engines. The four-cylinder Turbopower Diesel delivers 171 H.P. at 2300 R.P.M.; the six-cylinder engine produces 280 H.P. at 2300 R.P.M.

To truckers Turbopower means speedier, more economical movement of big payloads.

To boatmen it means faster speed or longer cruising range—more room for cargo.

To contractors and other industrial users it means greater work output from higher-powered engines or improved economy.

For the full story of 2-cycle Turbopower, write us or call your nearest GM Detroit Diesel Distributor or Dealer.

AMERICA'S LARGEST BUILDER OF DIESEL ENGINES

New Engines Added
to General Motors 2-cycle Diesel Line

Detroit Diesel Turbopower

. . . for more details circle 225, page 16

KWIK-MIX 16-S DANDIE®

handiest mixer you've ever seen

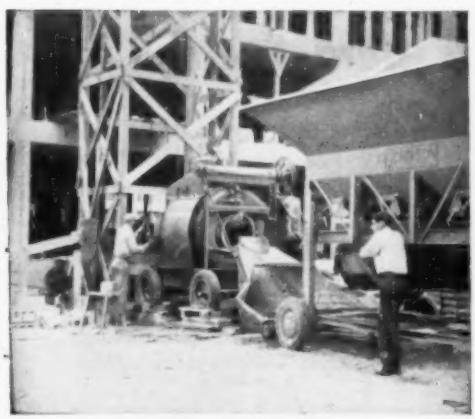
LOADS TRUCKS — Producing concrete for curbs and gutters, a Kwik-Mix 16-S Dandie mixer dumps batch directly into truck from ground level. Tower loader attachment gives 9 foot-2 inch discharge height. Big-capacity bucket holds full 17.6 cu. ft. mixer batch. It is powered by the mixer engine, dumps automatically at top of tower. Bucket travel and discharge are completed while the next batch is being

SETS UP AS CENTRAL-MIX PLANT — on bridge construction, two Kwik-Mix 16-S Dandie concrete mixers, with wheels removed, were set up side-by-side as permanent mix plants. Both were equipped with tower attachment for truck-loading operation. These big-capacity mixers also can be set up as stationary plants on elevated platforms by adding an extension track to charge the drum.

LOADS CONCRETE BUCKETS — Working on a state highway relocation project, this mobile 16-S Dandie mixed concrete for a series of box culverts — discharged batch into concrete bucket. To suit operating conditions, this versatile Kwik-Mix 16-S mixer is adaptable to side or end discharge. Axles are readily interchangeable on the square mixer frame. Change-over is easy, takes less than an hour.

KWIK-MIX COMPANY, Port Washington, Wis. (Koehring Subsidiary)

mixed. There's no delay to mixer production. Tower is easily attached. Top section is hinged, folds back for ample travel clearance. Tower loader attachment is also available on the 11-S Dandie concrete mixer, and on Kwik-Mix 10 and 14 cu. ft. bituminous mixers.



TEAMS UP WITH BATCHER — Concrete for a new apartment building was produced on the job by this Kwik-Mix 16-S mixer and Johnson Lo-Bin batcher — a low-cost, big-production team. (Other sizes in Kwik-Mix line include: 11-S, 6-S, 3½-S Dandie mixers.)

Also: Plaster-mortar mixers, bituminous mixers, Mote-Bugs.®

. . . for more details circle 249, page 16

Johnson ⅜ to 3-yard Clamshell Buckets

Smooth inside and out, Johnson all-welded clamshells dig and dump with less resistance . . . give fast clean discharge. They're quick-filling, easy-closing, because big needle bearing-mounted sheaves reduce friction loss, deliver full digging power to cutting edge. Hard manganese edge, welded to heavy lips, toughens with use. 3 types, 10 sizes: ⅜ to 3 yds. Also check Johnson line of concrete plants, bins, batchers, hoppers, silos.

C. S. JOHNSON • Champaign, Ill.
(Koehring Subsidiary)

NEW 155 Trenchliner® is low and narrow

Small and compact, the working height on Parsons new 155 Trenchliner is only 7 feet-4 inches. Width over crawlers 5 feet-4 inches for work and travel in crowded areas. It digs up to 25 feet per minute — 16 to 26 inches wide, at depths to 8 feet. Has downcrowd boom, hydraulic control, "Tap-In" teeth, power-shift spoil conveyor. Available on flat shoes or grouser-type treads. Also — 4 other Parsons models, all sizes, types.

PARSONS • Newton, Iowa
(Koehring Subsidiary)

20-ton capacity with Koehring 405 Crane

With one of these heavy-duty 405's, you're equipped to lift any load up to 20 tons. Boom lengths range from 40 to 90 feet. For added reach, 15 to 30-foot jib can be used on any length boom up to 80 ft. Extra lift-capacity and stability increases the 405's work capacity with all attachments. Converts to 1-yard shovel or hoe, handles 1 to 1½-yard clamshell or dragline buckets on wide work radius. 4 other Koehring sizes also available.

KOEHRING Company
Milwaukee 16, Wisconsin

V64

Properties of Low Alloy Welded Joints

By G. E. Nordmark, Z. Shoukry and J. E. Stallmeyer. Corps of Engineers, U. S. Army, Ohio River Division Laboratories, Mariemont, Ohio, January 1956, 46 pp. Highway Research Abstracts, March 1956.

FOR several years the Ohio River Division Laboratories of the Corps of Engineers has sponsored a research investigation at the University of Illinois relating to the weldability of structural steels. From the findings of the initial program, a correlation of the literature, it appeared that the introduction of the low hydrogen electrode represented one of the more promising developments in the field of weldability. Accordingly, several investigations were conducted to determine the effect of the presence of hydrogen in the weld metal on the bend properties of weldments, the fatigue strength of weld metal, and, finally, the fatigue strength of welded joints.

With the completion of the studies relating to hydrogen in the weld metal, programs concerning two other problems in the field of weldability were initiated. The results of the first and major portion of this study, an investigation of the fatigue and static properties of welded joints in low alloy structural steels meeting ASTM designation A-242, constitute Part I of this report and also an earlier report entitled, "Fatigue and Static Properties of Welded Joints in Low Alloy Structural Steels," January 1955. Part II of the present report concerns an exploratory investigation to develop a suitable method of studying the effect of the presence of a weld on the tendency toward brittle fracture of structural steels.

It appears that the fatigue strengths of steels meeting the requirements for ASTM designation A-242 may not differ appreciably in spite of the comparatively wide variations in their chemical compositions. Further, the presence of a weld in the steel reduces the magnitude of the variations between the average fatigue strengths of the different low alloy steels.

As indicated by the initiation of failure from internal defects for most of the transverse butt welds of steels T and Q, improvements in the welding materials or procedures are highly desirable. However, the present tests gave indications that the increase of fatigue strength resulting from the elimination of internal inclusions would only be on the order of 5 percent unless the severity of the stress concentration at the edge of the weld would also be reduced.

The low alloy steel joints have fatigue strengths 10 to 20 percent higher than those of similar joints of A-7 steel welded with E6010 electrodes.

New legislation will affect highway administration

Legislative bills have been under consideration in six states which would variously affect the administration of state highways.

A Michigan bill would create a $5 million revolving fund for right of way. An Arizona measure would create a new post of Highway Director at $15,000 salary.

A Virginia proposal would limit the highway commissioner to two successive terms.

In Kentucky a bill would reorganize some of the divisions of the highway department and create an 8-man highway commission to be advisory to the governor.

"Our equipment keeps on rolling—

We use Colmonoy No. 2, the Best Hard-Facing!"

You get top abrasion resistance and easy welding with low-cost Colmonoy No. 2 hard-facing electrodes. Use them on tractor treads, dipper teeth, ditcher teeth, truck beds, dragline buckets, any steel or manganese steel part.

Excellent arc stability and good flowing qualities make these low hydrogen AC-DC electrodes a cinch to apply. A Colmonoy No. 2 deposit has a Rockwell C hardness of 50 to 60.

Write today for more information about Colmonoy No. 2 and the rest of the Colmonoy family of hard-facing alloys.

HARD-FACING ALLOYS

WALL COLMONOY CORPORATION

DETROIT 3, MICHIGAN

BIRMINGHAM • BUFFALO • CHICAGO • HOUSTON • LOS ANGELES
LINDEN, N. J. • MORRISVILLE, PA. • PITTSBURGH • MONTREAL • GREAT BRITAIN

Available in 1/8, 5/32, 3/16, and 1/4-inch diameters, packed in 10-lb. sealed metal containers.

. . . for more details circle 312, page 16

A FULLY AIR-CONTROLLED 1¼-YD. MACHINE

THE NEW LORAIN-56

1¼-YD. SHOVEL

25-TON CRANE
(as fully convertible machine)

30-TON CRANE
(as heavy-duty lifting Crane on extra-wide crawlers)

ALL OF THESE FEATURES AND MANY MORE ARE STANDARD

2 LEVER "METERED" AIR OPERATION

Easier! Faster! Simpler! Uses only 2 levers to apply "Air-Ease" power to all turntable operations. A new concept in fingertip control. Retains full "feel" of machine.

"SHEAR BALL" MOUNTING

No centerpin or nut, no rollers to wear. No adjustments! Provides smooth, rock-steady, "ball bearing" swing. Nothing else like it on any other make of shovel-crane.

SQUARE-TUBULAR-CHORD CRANE BOOM

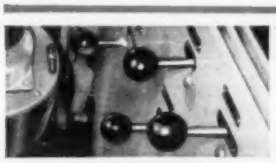
Lighter! Longer! Stronger! New, patent-applied-for design gives greater strength, less weight. Permits increased lifting capacities and working with longer booms.

TORQUE CONVERTER

Gives the smoothest, most productive power take-off that can be had. Multiplies engine torque. Effectively absorbs digging shocks and strains. No-stall, "never-say-die" power hangs on—maximum work obtained from the diesel engine.

ANTI-FRICTION BEARINGS

Now, anti-friction bearings on hoist and swing drums and travel shaft provide the ultimate in performance . . . smoother, more efficient.



AIR CONTROL OF CRAWLER

Now — air does the work, controls travel, steering, tread lock, swing-travel jaw clutches. Far greater ease of operation. Adds greatly to production.

REMOVABLE COUNTERWEIGHT

New design makes it possible to detach counterweight easily for lower weight when transporting this new Lorain over the highway. Can be removed or installed in minutes.

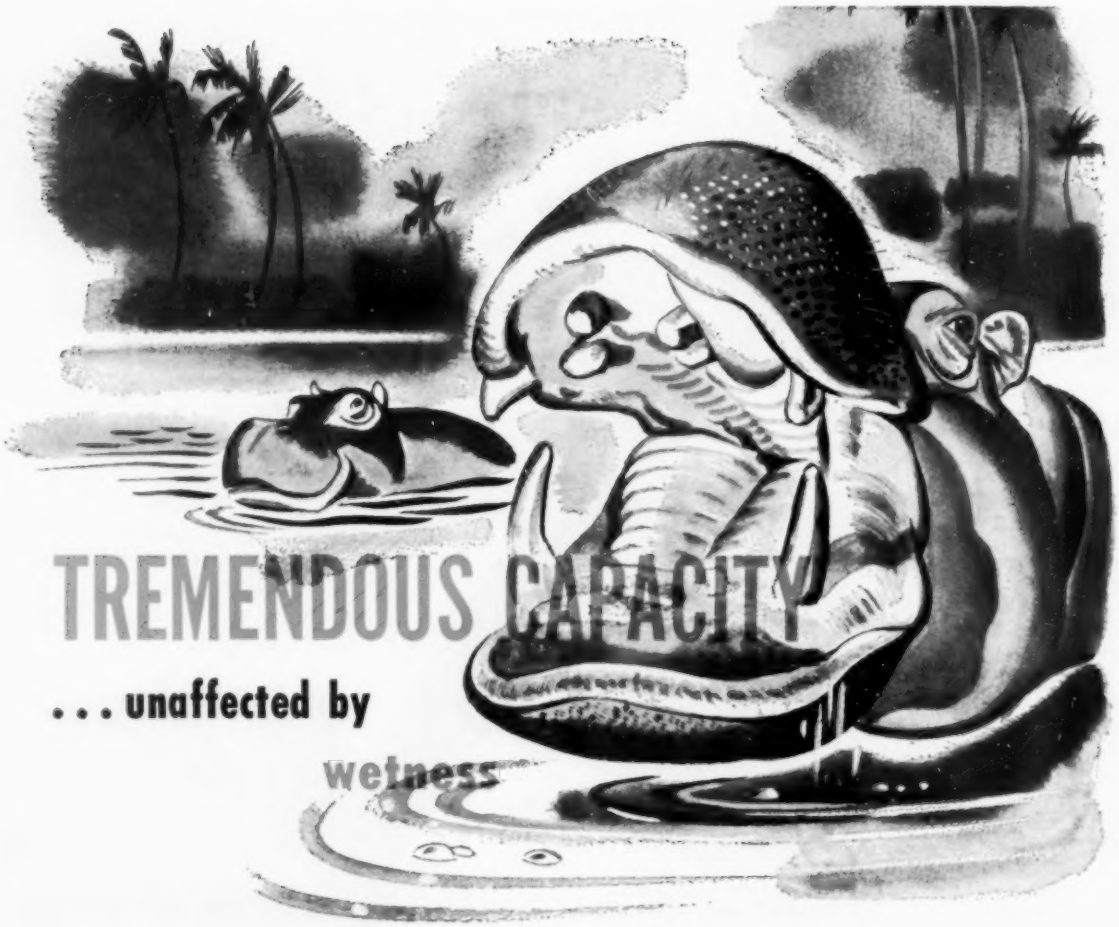
Here's the newest 1¼-yd. shovel-crane, the Lorain-56 —and it has *all* the newest, most advanced features combined into one machine. 2-lever, metered air controls... "Shear Ball" mounting... torque converter... and many, many other *standard* features are included. Operators will like its simple, easy operation and freedom from adjustments. Owners will find the resulting higher production profitable. A few of these outstanding features are briefly described at the left. Get the *full* Lorain-56 story from your Thew-Lorain Distributor now!

THE THEW SHOVEL CO., LORAIN, OHIO

THE NEW LORAIN.

ASK YOUR THEW-LORAIN DISTRIBUTOR FOR FULL DETAILS ON THIS NEW MACHINE

. . . for more details circle 291, page 16



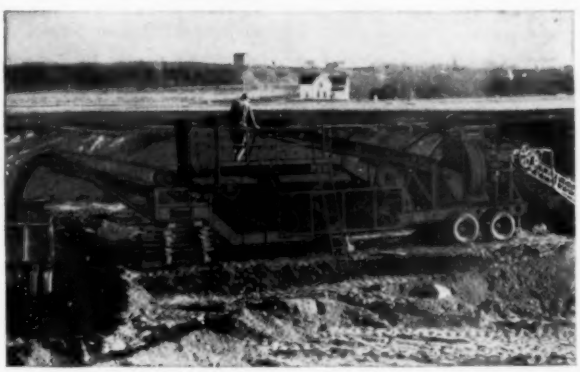
Big and adaptable, the hippo is a master in water. He can float like a log . . . submerge for 30 minutes . . . run across the bottom of a lake at eight miles an hour. On land, he runs as fast as a man . . . gallops at considerable speed . . . forages more than 25 miles a day to satisfy his huge appetite.

Universal built the 880 SENIOR "R" GRAVELMASTER like Nature built the hippo — for sustained performance under any conditions.

Wet, sticky material won't stop production when you're operating an 880 Senior "R". A 10" x 36" jaw teamed with a 30" x 26" roll crusher and a 4' x 12' inclined gyrating screen assures tremendous capacity. It takes an *inclined* gyrating screen to handle water-soaked pit-run material smoothly and efficiently.

Big and adaptable, the 880 Senior "R' can range like a hippo over wide territory. Travel it cross-country and see! The hippo-like quality of tremendous capacity unaffected by wetness adds to your profit when you own an 880 Senior "R".

Compare the 880 Senior "R" with competitive plants and you'll find a lot of other hippo-like features. Everything bigger — but the price!



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PETTIBONE UNIVERSAL
In Cedar Rapids Since 1906

UNIVERSAL ENGINEERING CORPORATION
631 C Avenue N.W., Cedar Rapids, Iowa
A Subsidiary of Pettibone Mulliken Corporation, 4700 W. Division St., Chicago 51, Illinois

. . . for more details circle 301, page 16

PRESTRESSED CONCRETE PRODUCTION— A PROFITABLE, FAST-GROWING BUSINESS

The plant of Prestressed Concrete Inc., St. Paul. Building is 50' x 235', with additional 100' of craneway and storage yard at rear. Construction is entirely of precast columns and wall panels, with 50' clear span prestressed girders and channel slab roof construction.

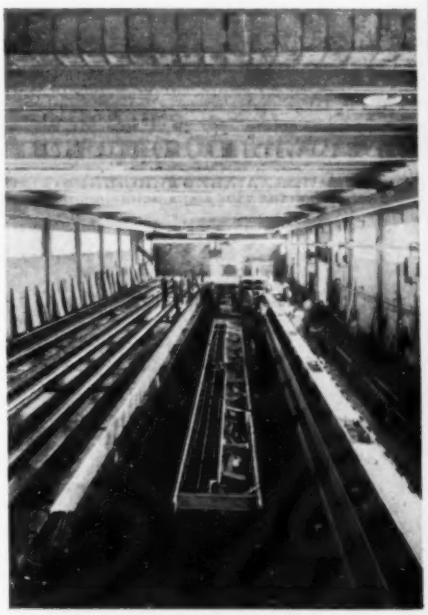
IN THE LAST THREE YEARS, pre-tensioned bonded prestressed concrete structural members have thoroughly demonstrated both their superior physical properties and their outstanding economy. Today they are universally accepted. All that prevents their use by many architects and engineers is the lack of nearby casting facilities.

Many casting beds are located outdoors where the investment can be held to a minimum. In mild climates an efficiently designed yard, operating all year, can produce about four times the amount of investment. Adverse climates reduce output in proportion to weather conditions.

However, Prestressed Concrete Inc., located in St. Paul, Minn. where temperatures range from a congealing 30° below zero to a sizzling 100° above, has its casting yard completely enclosed as pictured here.

The cost of this yard, including its overhead crane, but not including land and concrete mixing equipment, was about double that of an open yard. But housing of the necessary machinery and curing facilities permits continuous operation. Products to date include prestressed channel slabs, beams and girders as well as precast columns and wall panels. Yearly output sells for more than twice the amount of the original investment.

If you are interested in the possibility of establishing a casting yard, ask us for information and suggestions. Construction Materials Division, John A. Roebling's Sons Corporation, Trenton 2, N. J.



Four channel beds at left are 200' long. In center is bed for precasting reinforced beams. Next to the right is a 100' bed for prestressing beams. At far right is a form for precasting columns.

Roebling 7-wire strand, showing valleys between wires which produce mechanical bond.

ROEBLING

Subsidiary of The Colorado Fuel and Iron Corporation CF&I

. . . for more details circle 277, page 16

How 2,000 Year Old Appian Way Looks Today

● The cobblestones of the ancient Appian Way re-appear from under the thick blanket of mould which has been covering it for centuries, as archaeologists pursue digging operations at a location on the road near Minturno, 70 miles southeast of Rome. (United Press.)

Air surveys save year on final turnpike line

Air surveys are speeding final design and location of the Northern Illinois Toll Highway. They are being performed for the Illinois Toll Highway Commission by Aero Service Corporation, photogrammetric engineers, under a $140,000 contract. The route strip, 193 miles long and 500 feet wide, covers a circumferential route around Chicago with extensions northward toward Milwaukee, northwest to Beloit, and westward to Aurora.

Fully detailed topographic maps, with one foot contour interval and a horizontal scale of 1 in. equals 50 ft., are being prepared for commission officials.

These maps will show manhole covers, curb lines, telephone poles, and other needed information for final steps of highway design, along with buildings, streets, fences, railroads, and rivers.

Aerial photography, the first step in the mapping project, has been completed. More than 1400 air photos (9″x9″ prints) were made to cover the route.

It was estimated by Aero Service engineers that all topographic maps would be delivered within 60 to 90 days.

The air survey is reportedly bringing very substantial savings in time and costs, saving at least a year of effort.

Last year, Aero Service mapped 465 miles of preliminary routes in 75 days for the Illinois Toll Highway Commission.

Final route alignment of the highways was made from these maps.

"25 Years of Sales and Trouble-Free Service of Barnes Pumps — They've Got to be Good!"

L. K. Richards,
Richards Equipment Co.,
Waco, Texas,
Contractors Supplies and Equipment.

"AFTER 25 YEARS OF SALES AND TROUBLE-FREE SERVICE OF BARNES PUMPS, WE KNOW THEY ARE THE BEST."

Our business is built on good equipment and good customers. Barnes Manufacturing has played no small part in our growth and progress in the past 25 years. We are proud of our Barnes Distributorship. We feel they build the best pumps in the construction industry.

G. H. Richards

Barnes 90M
Self-Priming
Centrifugal Pump
Gasoline Driven

BUY THE BEST . . . BUY BARNES SELF-PRIMING CENTRIFUGAL PUMPS
3,000 to 90,000 GPH — Gasoline, Diesel, Electric or Pulley Drives

BARNES MANUFACTURING CO.
Mansfield, Ohio • Oakland 21, Calif.

forward action in '56

FOUNDED 1895 Barnes MANUFACTURING CO. MANSFIELD, OHIO

. . . for more details circle 189, page 16

Galion Allsteel Model 19TTE Excavator trailer dump with 45 ton Model 88381 Duo-scopic Hoist.

1,920 cubic yards a day on a 15 mile haul

Galion Allsteel Model 19TTE Excavator trailer dumps are outstanding performers in the excavating equipment fleet of Greco Contractors, Chicago, Illinois.

Greco operates 8 of these units on the Congress Street Expressway job in Chicago. Loaded by shovel or dragline, each of these trailer dumps handles up to 30 cubic yards of material and makes 7 to 8 fifteen mile round trips to the dump each shift, through heavy traffic.

Built to haul large quantities of excavated material over the highway to distant disposal points, Excavator trailers are engineered to provide even weight distribution on trailer and tractor axles. And, they are constructed to withstand the damaging effects of shovel loading.

An order for 3 additional Model 19TTE's has just been placed by Greco Contractors. Describing the Congress Street job, Mr. P. J. Greco says: "We are hauling a mixture of rock, broken concrete and a very sticky mud. The combination of 6-inch radius floor corners, tapered body, barn door type tailgate and good dump angle gets rid of the material with no difficulty. Stability in dump position is remarkable. We also like the way the load is distributed on the trailer and tractor axles."

Find out how Galion Excavator trailer dumps can meet your heavy material hauling requirements. Your nearby Galion Allsteel distributor will recommend the model exactly suited to your job. Call him today! AA-1233

THE DUO-SCOPIC **GALION** ALLSTEEL BODY COMPANY • GALION, OHIO

Small job or Big project...

On this Florida Turnpike contract of Blythe Bros., two TS-18 "Eucs" loaded, hauled and dumped in sandy conditions that "hung up" other equipment. The tremendous power and traction of this Euclid scraper made it a logical choice for this tough job.

Western Contracting Corp. used 12 of these TS-18 Euclid Scrapers on a 7 million yard Indiana Turnpike job. Because of the extremely difficult sandy conditions, the tractors were equipped with 300 h.p. engines. Top extensions added 6½ yds. to the bowl capacity.

EUCLID TWIN POWER

in the TS-18 provides more work-ability than you get in any other scraper

Twin-Power—the use of two engines driving separate axles—was pioneered in the earth moving field by Euclid 10 years ago. Torque converters and semi-automatic transmissions assure easy operation and a smooth flow of power matched to all job conditions. One of Euclid's newest scraper models, the TS-18 uses power and drive components that have proved their dependable performance in other "Eucs" on hundreds of jobs.

The TS-18 is powered by two 218 h.p. engines—one in the tractor and another behind the scraper bowl. For work where even more power can be used, a 300 h.p. engine for the tractor is available. Both engines drive through separate Torqmatic Drives. Standard tires are 27.00 x 33 with 33.50x33 available as optional equipment.

Lever action and hydraulic control of bowl, apron and ejector make the TS-18 easy to operate. At the Glasgow Air Base in Montana, Harris Construction Co. used 4 of these Twin-Power Scrapers for grading and construction of runways.

EUCLID DIVISION
GENERAL MOTORS CORPORATION
Cleveland 17, Ohio

this TS-18 "Euc" *cuts earth moving costs!*

VERSATILITY
for a wide range of work!

This TS-18 is the most recent development of the Twin-Power principle pioneered by Euclid and job proved in earlier scraper models. Its unequalled power and traction gets more work done... sets a new standard for low cost scraper yardage. Self-loading in practically any material from loose sand to hard shale, the TS-18 is a one-man earthmoving spread. It works on steep grades and under job conditions that stymie other scraper equipment.

Hydraulic lever action does away with cable headaches and expense. All scraper operations—bowl, apron and ejector—are independently controlled. All four of the hydraulic jacks are interchangeable... one spare fits anywhere. The low, wide bowl design and reversible four-section cutting blade make the TS-18 easy to load ...heaped loads up to 24 yds. are picked up fast.

Like all other Euclid Scrapers, the TS-18 is built to stay on the job with less down-time for servicing and repair. All major components are readily accessible... a feature that really pays off in more work-ability and lower maintenance cost. Your Euclid dealer has facts and figures showing why owners everywhere say that ***Euclids are your best investment.***

Euclid Equipment

FOR MOVING EARTH, ROCK, COAL AND ORE

. . . for more details circle 226, page 16

Saved... a LIFE, a cargo and a complete rig!

On an icy stretch of the West Virginia Turnpike last winter, a driver lost control of his loaded tractor-trailer and headed for a deep ravine. The entire rig smashed into the Barrier-Beam guard rail, was deflected and came to a stop on its wheels with cargo intact and driver unharmed.

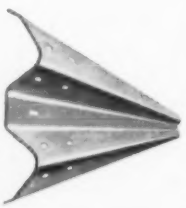
Specify USS BEAM-TYPE GUARD RAIL

BARRIER-BEAM

A rugged deep beam section with the famous rounded Safety-Top, noted for high impact strength, good deflection, maximum protection and ease of installation and maintenance.

UNIVERSAL-BEAM

A standardized interchangeable deep beam rail having turned-back edges and featuring easy erection, strength, and simplification of purchasing, stocks, and maintenance.



Write for Literature

USS STEEL PRODUCTS

UNITED STEEL FABRICATORS, INC.
WOOSTER, OHIO

Hollow Metal Doors • Prefabricated Metal Buildings • Window Wells
Highway Guard Rail • Bridge Flooring • Corrugated Metal Pipe
Sectional Plate Pipe and Pipe Arches

. . . for more details circle 300, page 16

Letters

To the Editor:

This is in reference to your articles by Jack H. Gould, "Bituminous Overlay Strengthens Wartime Fighter Base for Modern Commercial Aircraft," October, 1955, and "Perforated Concrete Subdrains Installed to Correct Pumping of Runway Pavement," Roads and Streets, January, 1956.

Although we have had a great deal of rain this winter, pumping action on Runway 6-24 following the overlay and underdrainage described, has decreased considerably. No pumping action has been observed where the asphalt was placed in the center strip of the runway, but there have been a few cases in the gravel area. We hope by this time next year that all this pumping action will have ceased.

J. S. Sorsensen
Airport Manager
Richard E. Byrd Flying Field
Sandston, Virginia

Comment Invited

Letters are invited from readers of ROADS AND STREETS commenting on or discussing recent articles, or making observations on matters of current interest in the road building profession and industry. Address editor ROADS AND STREETS, 22 West Maple Street, Chicago 10, Illinois.

New methods division

An innovation in state highway department set-up, in line with the growing responsibilities of such organizations, is the creation of a new unit of Methods Procedures within the New York state department of public works.

As announced by superintendent John W. Johnson, this unit will be responsible for departmental functions in the area of management planning. Continuing studies will be made to improve the operations of the various bureaus at the Albany headquarters as well as the 10 district offices.

The new unit will be established and supervised by Clayton E. Sumner, carrying the position of principal examiner of methods and procedures, and will be staffed by civil service personnel. Mr. Sumner is a career civil servant who has spent the last nine years on office methods within the New York state department of taxation and finance.

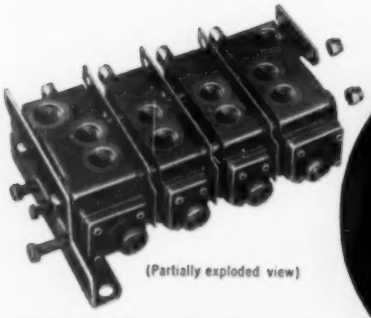
. . . for more details circle 226, page 16

MARION operators *ride on air*

. . . . . well, it's <u>almost</u> like riding a cloud when Marion Air Control takes the heavy push and pull out of shovel running. You control main machine motions with a maximum of only 12 pounds hand pressure. You can inch the load or hold it with simple wrist pressure. Operators stay fresh and fast all shift long. Cycle time is shortened without extra effort. Machinery lasts longer. Marion <u>engineered</u> air control has thoroughly proved its value in the field; requires minimum maintenance. Ask your Marion distributor what it can mean on your work. Your output rises when your operator rides on air.

MARION POWER SHOVEL COMPANY
MARION, OHIO

. . . for more details circle 266, page 16

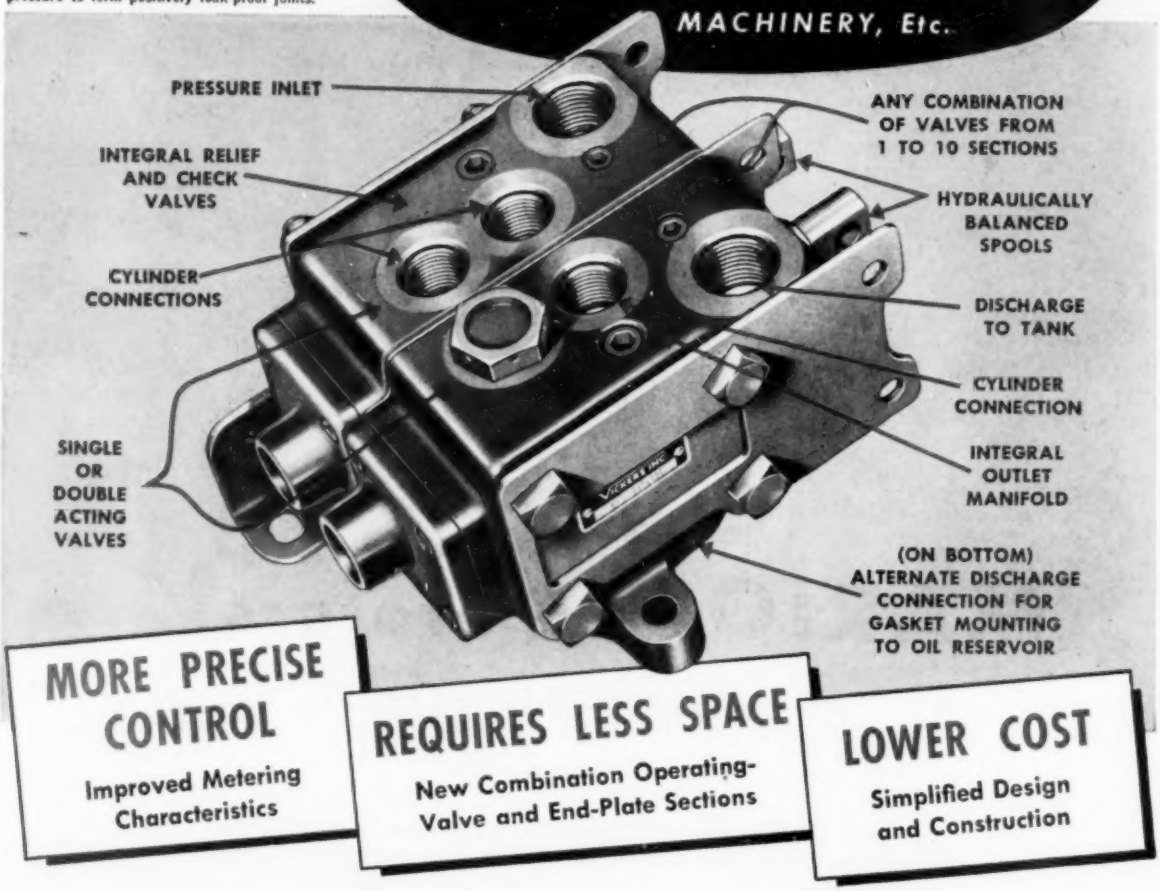


(Partially exploded view)

"O" ring seals between valve sections seal with pressure to form positively leak-proof joints.

Series CM11 VICKERS® MULTIPLE UNIT VALVES

For MATERIALS HANDLING EQUIPMENT, FARM TRACTORS, BUCKET LOADERS, CONSTRUCTION and MINING MACHINERY, Etc.


PRESSURE INLET
INTEGRAL RELIEF AND CHECK VALVES
CYLINDER CONNECTIONS
SINGLE OR DOUBLE ACTING VALVES
ANY COMBINATION OF VALVES FROM 1 TO 10 SECTIONS
HYDRAULICALLY BALANCED SPOOLS
DISCHARGE TO TANK
CYLINDER CONNECTION
INTEGRAL OUTLET MANIFOLD
(ON BOTTOM) ALTERNATE DISCHARGE CONNECTION FOR GASKET MOUNTING TO OIL RESERVOIR

MORE PRECISE CONTROL
Improved Metering Characteristics

REQUIRES LESS SPACE
New Combination Operating-Valve and End-Plate Sections

LOWER COST
Simplified Design and Construction

This is a more compact and versatile design of valve. End sections combine in one casting the inlet or outlet manifold plate together with any operating-valve section. Inlet section also contains relief valve. Individual outlet plates available for single unit valves. Single- and double-operating valve sections can be added between end sections as needed. Valve can be adapted for tandem (series) operation. Single-acting valves available for either direction of lever shift.

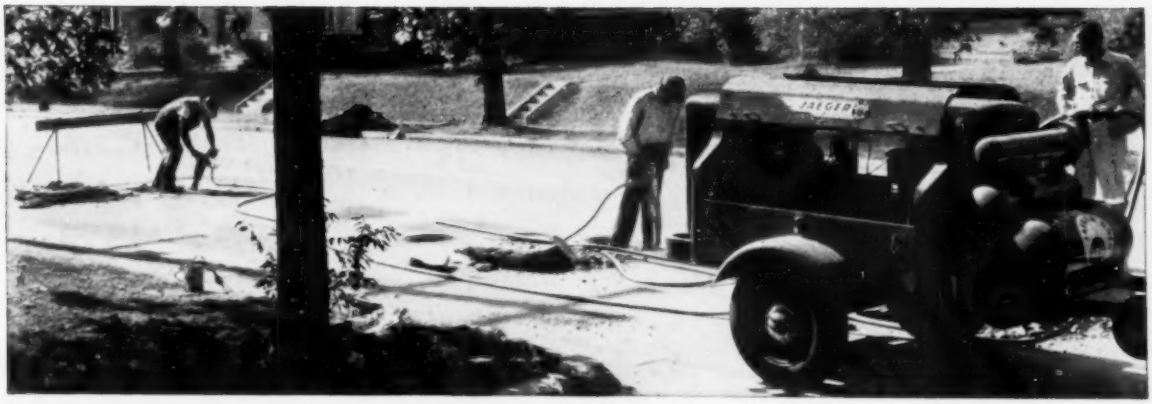
Other features include protection of pump from reverse flow during shifting . . . three point mounting for more simple installation . . . cylinder connections with ¾-16 N.F.-2 straight threads (AND 10050 type) help insure leak-proof connections . . . optional outlet ports in end section so valve can be gasket mounted to the oil reservoir or pipe connected. Designed for use with Vickers Series V-200 Vane Pumps (up to 11 gpm), the CM11 Valve can be used up to 2000 psi working pressure. For further information write for Catalog No. M5101-A.

7496

VICKERS INCORPORATED
DIVISION OF SPERRY RAND CORPORATION
ADMINISTRATIVE and ENGINEERING CENTER
Department 1432 • Detroit 32, Michigan
Application Engineering Offices: • ATLANTA • CHICAGO CINCINNATI • CLEVELAND • DETROIT • HOUSTON • LOS ANGELES AREA (El Segundo) • MINNEAPOLIS • NEW YORK AREA (Summit, N.J.) • PHILADELPHIA AREA (Media) • PITTSBURGH AREA (Mt. Lebanon) • PORTLAND, ORE. • ROCHESTER • ROCKFORD • SAN FRANCISCO AREA (Berkeley) • SEATTLE • ST. LOUIS • TULSA WASHINGTON • WORCESTER
IN CANADA: Vickers-Sperry of Canada, Ltd., Toronto

ENGINEERS AND BUILDERS OF OIL HYDRAULIC EQUIPMENT SINCE 1921

. . . for more details circle 302, page 16



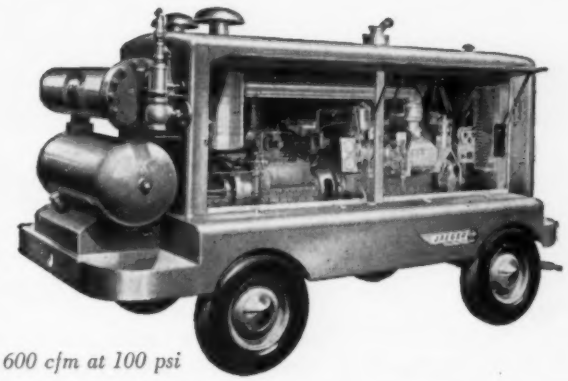
TO MINIMIZE TRAFFIC INTERFERENCE on a busy street, two cuts at a time are being made on this job of replacing gas main clamps. Cuts are 30" sq. and 26" average depth and are being backfilled immediately. The Jaeger Air-Plus Roto® 125 compressor has the capacity to run both heavy breakers at top efficiency.

BACKFILLING 7 MILES OF TRENCH after laying a utility line, this Jaeger "125" Roto is being used to operate a triplex tamper. The users report: "We liked our first Jaeger Rotary so well we bought two more".

Jaeger 125 Rotary speeds your street work

With a Jaeger 125 "Roto" you have *constant* 100 lbs. pressure under all air demands up to 125 cfm—enough to run two 80 lb. breakers at top efficiency. You have tool boxes that hold a full set of tools. You have a machine that's easier to trail and spots by hand. And you have the most efficient rotary compressor unit built, producing air at slower engine speeds, low temperatures and with fuel economy that is money in the user's pocket.

Jaeger Rotaries are also available in 365 and 600 cfm sizes, for larger work. For complete information or demonstration, see your Jaeger distributor — or send for latest Catalog JCR5.



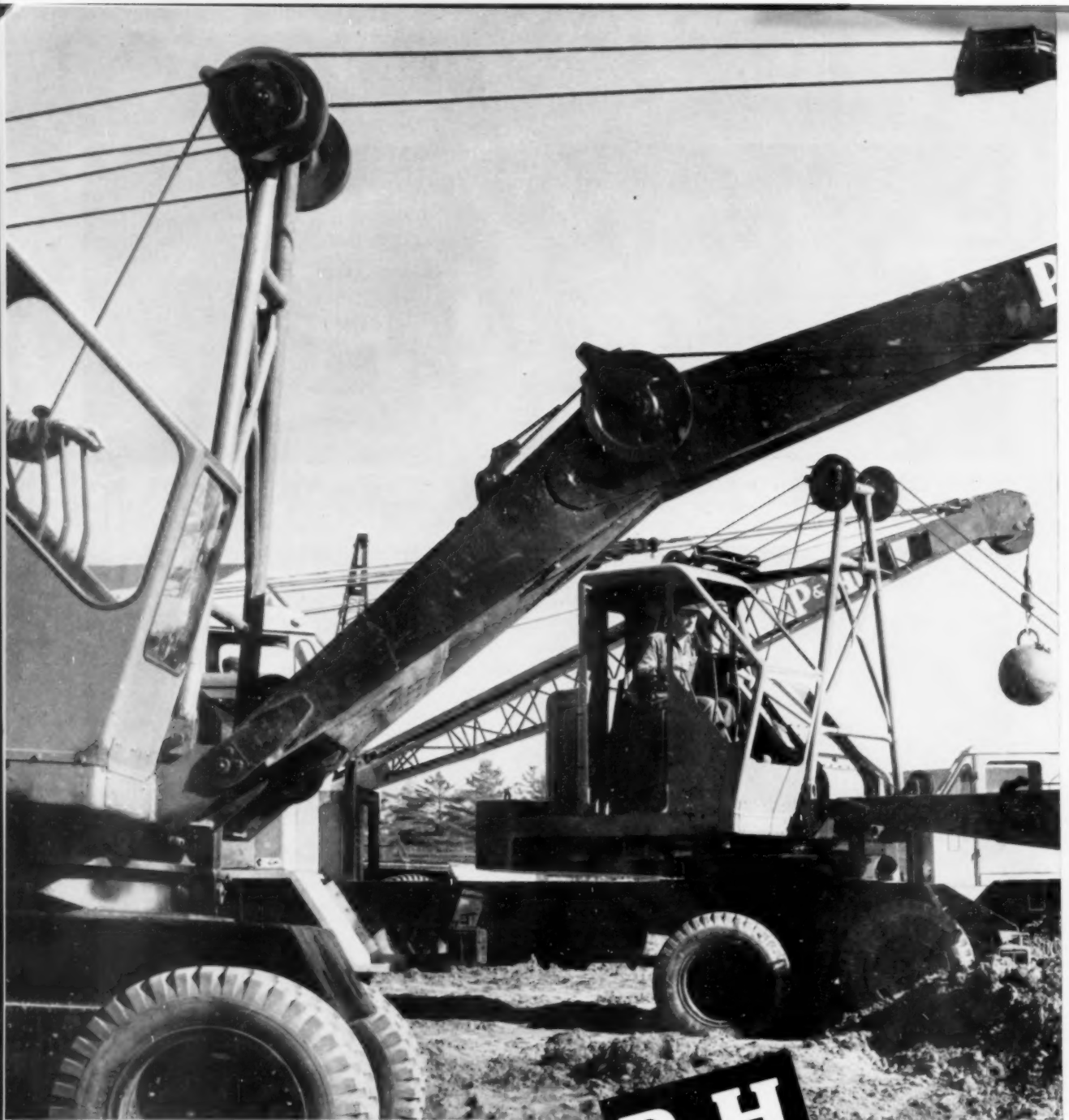
Model "600" Air-Plus Roto — 600 cfm at 100 psi

THE JAEGER MACHINE COMPANY

223 Dublin Avenue, Columbus 16, Ohio

PUMPS • MIXERS • TRUCK MIXERS • SPREADERS • FINISHERS • LOADERS

. . . for more details circle 247, page 16



Proving that P&H has

Today P&H is recognized as the leader in the excavator industry.

Why?

Because P&H, and P&H alone, has taken excavators out of the steam shovel era and applied automotive-type construction, automotive-type power trains and automotive-type controls to power cranes and shovels.

The result?

Power crane and shovel performance that delivers the highest net operating profit.

No matter what your shovel or crane needs are, be sure to get the full, profitable benefits of P&H unit rolled construction, *fabricated by arc welding.* This feature *alone* eliminates troublesome assembly by multiple mechanical joints, bolts, rivets and tie rods!

Get the full P&H story—proof that P&H has the "guts" to do any job; proof that is borne out every day on the Harnischfeger Proving Grounds where every shovel and crane is thoroughly tested. Harnischfeger Corporation, Milwaukee 46, Wisconsin.

the P&H *Line*

TRUCK CRANES · DIESEL ENGINES · POWER SHOVELS · PREFABRICATED HOMES · HOISTS · SOIL STABILIZERS · WELDING EQUIPMENT · OVERHEAD CRANES

the GUTS to do the job!

The unretouched photograph above shows P&H equipment being tested at the Escanaba, Michigan, Harnischfeger Proving Grounds

For Modern Engineering, Look to

HARNISCHFEGER

. . . for more details circle 232, page 16 Power Crane & Shovel Division

AGC Executive Staff Realigned

FRANK J. ROONEY, president of The Associated General Contractors of America, has announced several changes in AGC's national staff, following a meeting of the association's executive committee. These were announced in a letter to AGC members as follows:

"H. E. Foreman, managing director, while much improved in health is not able to resume full activities and responsibilities required of the chief executive of the association without impairment to his health.

"James D. Marshall, who has served as executive director or assistant managing director for 17 years, has been given the full responsibility and authority of chief executive in the management of the association, retaining the title of executive director.

"Mr. Foreman continues under the title of managing director, performing the important duties of consultant and advisor on high-level policies, trends and economic developments, thereby continuing on a full-time basis to give the association the benefit of his outstanding construction association experience and knowledge without overtaxing his health.

"William E. Dunn has been named assistant executive director, with the duties and responsibilities of that position, and will continue special attention to labor matters and legislation.

"Charlson I. Mehl has been appointed administrative secretary.

"The advancement of these two younger men will place them in charge of many new management duties in addition to those formerly performed by C. S. Embrey, who is now in part-time employment by the association as a consultant.

"Edward T. Kelly will be advanced in the Labor Department to assume additional responsibilities and authority in that department.

"The officers and Executive Committee," this letter concludes, "believe that these changes will insure the continuation of the fine accomplishments your association has been obtaining for its members and the construction industry."

Mr. Foreman has been AGC's managing director since 1940. Mr. Marshall became executive director in 1953, after long service as assistant managing director. Mr. Dunn has been Labor Department manager. Mr. Mehl has been administrative assistant for several years.

Mr. Kelly, a member of the Labor Department's staff for many years, and a member of the National Joint Board for the Settlement of Jurisdictional Disputes, will assume some of the responsibilities held by Mr. Dunn before his advancement to assistant executive director.

Test lighting for Connecticut expressway

Final selection of the lighting system for the Connecticut Turnpike will be based on the results of a test now under way. Mercury vapor and fluorescent luminaires are being tested on adjoining parts of a one-mile section of roadway.

The test was considered necessary according to a state highway department spokesman, because of lack of information on comparative performance of the two systems of lighting on high speed highways.

Available information deals with interchanges and city streets, while this test is on a section of roadway which will be a part of the completed Connecticut Turnpike.

The poles and wiring system for the test are so installed that only minor alterations will be needed to provide the entire section with whichever system is approved for permanent use.

The mercury vapor and the fluorescent luminaries are rated at 20,000 lumens each. The installation is evenly divided between the two types of luminaires. Poles are placed 200 ft. apart on each side of the roadway and staggered to provide a light source every 100 ft.

The luminaries will be mounted at an angle of 25 degrees which is believed to provide the most effective distribution over the roadway. This type of angle mounting is made possible because several manufacturers have developed slip fitter mounts not heretofore available.

Physical measurements are being taken and extensive observer reactions have been recorded. These will be evaluated by Wilbur Smith and Associates and by department engineers.

(Advertisement)

● A McKiernan-Terry S10 Single-Acting Pile Hammer starts underwater to drive 195-foot 14-inch H-beam 70 feet below water for Richmond-San Rafael bridge foundation on the West Coast. McKiernan-Terry Corporation, 30A Mercer St., Dover, New Jersey.

. . . for more details circle 262, page 16

Why Bucyrus-Erie QUALITY means Dependable Performance . . . Year after Year

Bucyrus-Erie has long stood for QUALITY in excavating equipment. Drawing upon 76 years of experience, its engineers have never relaxed their study of construction needs . . . their program of testing and research . . . or their policy of applying latest metallurgical and technical advances to the fully convertible power excavators and cranes they design.

Such careful study pays off in Bucyrus-Erie *Individual Design* where the right balance between power, weight, and speed delivers sustained high output at low cost *over a long period of time.* Each model — from ⅜- to 4-cu. yd. — is designed to handle its rated capacity with top efficiency year after year. There is no overdippering or underpowering simply to create "new" models. No parts are too big, none too small . . . and each is test-proved to assure highest quality.

Experienced users everywhere recognize the value of Bucyrus-Erie's close attention to quality in design, in materials, in manufacturing, and in service. They are convinced by top performance; long-life construction; simple, easy control; and on-the-job dependability. They know, too, that whatever equipment tomorrow's construction will demand — they can rely on Bucyrus-Erie to build it with the same *quality control.*

You can benefit, too. Learn how from your nearby Bucyrus-Erie distributor or write us direct.

210E56C

Gleason flame hardening applies long-life, wearing quality where it counts most on gears and pinions — extra hardness where drive teeth mesh.

BUCYRUS-ERIE COMPANY

SOUTH MILWAUKEE
WISCONSIN

NO TRAFFIC INTERRUPTIONS ON 80-FOOT FREEWAY CONSTRUCTION

Fast Mixing of Cement Treated Sub-base Key to Successful "Foothill Freeway" Job

Transforming a 30-foot wide California street into a major 80-foot 4.48 mile freeway, without obstructing traffic or utility lines, within cost and time limitations is an accomplishment recently completed in Los Angeles County. One of the most serious construction problems, the tricky cement-treatment for the 6-inch sub-base course, was handled profitably with the help of a Seaman-Andwall TRAV-L-PLANT and a Seaman-Andwall HERCULES Cement Spreader.

Construction consisted of ripping out bituminous shoulders along each side of the old pavement, building necessary widening areas with grading equipment, cement-treating six inches of granular sub-base material along both sides of the old pavement, placing four inches of asphalt plant mix over this base course, and resurfacing part of the boulevard slab with two inches of plant-mix asphalt — merging all in a finished freeway plan.

Sub-Base Treatment

Probably one of the most unusual items in the project was the treatment of six inches of sub-base material with 2½ percent by weight of portland cement — to introduce greater stiffness into the sub-base and to reduce the plasticity index. This construction varied from 23 to 44 feet wide, and was handled in sections averaging 600 feet in length — the amount of square yardage that could be handled in half a shift. This practice follows national recommendations proving definite relationship between prompt mixing, blending, compaction and specified added strength of the finished base.

After a section had been leveled and made ready for this treatment, bulk cement was applied by a Hercules Spreader and metered in precise percentage as demanded, laid down in a flat strip just ahead of the mixing operation.

Dry-Mixing, Wet-Mixing

After the cement was laid down, an initial dry-mixing pass was made first by the Seaman-Andwall TRAV-L-PLANT to develop an excellent blend. With rotor and tines set accurately for the exact six-inch mixing depth, the TRAV-L-PLANT action mixed and moved sub-base particles laterally as well as horizontally for an intimate blend with the cement. On the second pass, the TRAV-L-PLANT was hooked to a water tank-truck, applying approximately 8½ percent moisture through the TRAV-L-PLANT's pump, meter and spray bar at a rate of about 200 gpm. After this pass, a tempering or additional mixing pass followed, leaving a beautifully uniform, damp strip of cement-treated base, ready for final compaction.

Despite the difficulties of restricted work areas, the need for continuing traffic, and interference with utility connections, some excellent performance records were chalked up. The TRAV-L-PLANT completed an average of 68,500 square feet of cement-treated base in a day's time, at unusually low cost. The self-propelled Seaman-Andwall TRAV-L-PLANT had several advantages. Staying out of the way of traffic, getting in and out fast, staying ahead of other machines, and keeping up with the cement-delivery operation.

The job was handled by Schroeder & Co. of Sun Valley, California, under the general supervision of John V. Hayden, General Sales Manager and Chief Estimator, with John Sawyer, Field Construction Superintendent.

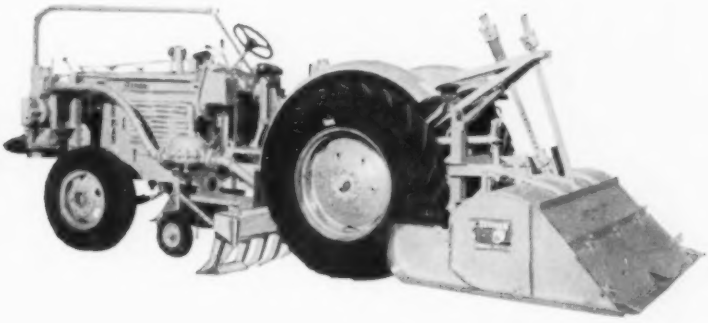
Cement, carefully metered to precise 2½ percent by weight is applied by Seaman-Andwall Hercules Spreader, to leveled and graded sub-base material.

Initial dry-mixing pass with Seaman-Andwall TRAV-L-PLANT with rotors and tines set for the full six-inch mixing depth, provides a uniform and intimate blend of cement and materials.

After the dry-mixing operation the TRAV-L-PLANT pumps water from a tank-truck and applies the moisture through integrally mounted pump, meter and spray bar, mixing the water into the full depth. Leaves a uniform, damp strip of cement-treated base, ready for final compaction.

ACCURATE SPREADING • FAST MIXING

your answer to soil-cement stabilization problems.



Seaman-Andwall HERCULES Cement Spreader
Spreads with absolute accuracy

This modern heavy-duty box-type spreader is designed for fast, accurate spreading of bulk cement in any amount required up to 10 feet in width. Special strike-off bars provide quantity control, the first bar delivers approximate quantity to conveyor; the second bar measures exact desired quantity. Dual pneumatic tires for traction and mobility, operate an Auto-Type Differential, permitting efficient transfer of power at all times. Fast, smooth-operating, easy adjustment, quick installation, are proven advantages.

Seaman-Andwall TRAV-L-PLANT
Mixes faster, more thoroughly

Completely self-propelled, fast and versatile, the TRAV-L-PLANT does a thorough and more uniform job of mixing in either new construction or reconstruction. Blends coarse and fine aggregates, fills voids and mortars-in the coarse securely for greater load-bearing value.

Pump, spray bar, tachometer assemblies and volumetric meter apply water or bitumin simultaneously with in-place mixing operation. Gasoline or Diesel powered, 7-foot mixing width. Can also be equipped with special Underbody Scarifier for light scarification.

Other Sta-Bilt Equipment:

- Self-Propelled Pulvi-Mixers
- 2-3 Ton Portable Steel Wheel Rollers
- Century Material Spreaders
- Portable Rock-Busters

Write for FREE bulletin "Processing Soil Cement". Illustrates and describes new methods and equipment for building soil-cement roads at lowest costs.

Seaman-Andwall PNEUMATIC COMPACTOR
Compacts to higher densities

A revolutionary new design, self-propelled for transport road speeds up to 20 m.p.h. this new Seaman-Andwall Pneumatic Compactor provides better compaction to higher densities. Front drive provides new "straight down" pressure to avoid pushing action, surface shear, scuffing, material displacement, even in turning. Power steering permits easy 180° turn on a 21-foot road. Ballast compartment provide weight adjustments up to 20 tons. Complete with electric brakes and lights for night transport.

Close-up of dry-mix operation showing heavy spill-over of materials ahead of the TRAV-L-PLANT rotor to provide multiple re-mixing cycles. Fines and coarse materials are blended thoroughly all directionally then partially compacted by strike-off plate at trailing edge of mixing chamber.

. . . for more details circle 281, page 16

STABILIZING THE WORLD

SEAMAN-ANDWALL CORPORATION

291 No. 25th Street • Milwaukee, Wis.

April in Northern Minnesota Calls for Heavy Equipment

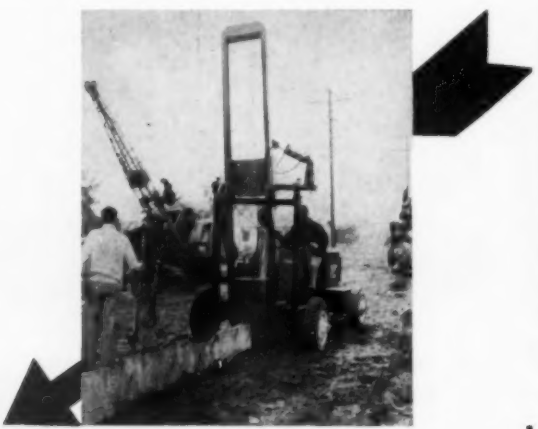
● Opening up a road in Northern Minnesota, this past April. Bulldozers owned by the National Guard cutting through a snowbank to open up an evacuation highway, in anticipation of a possible flood of the Red River which would require residents of the area to move. (Wide World Photo).

Revise rules on snow removal accidents

Because prevention of additional accidents is considered more important than completion of an accident report, a ruling has been made by the Missouri state highway department that drivers of state highway snow removal equipment need not remain at the scene of minor accidents involving only property damage until a state patrolman arrived. Instead, they now are authorized to proceed with their work and make their report when their work is completed.

In cases of minor accidents, the state equipment driver should secure from and give to the other driver all information necessary for the required accident reports, then continue on his way and make his report later. However, in cases of accidents involving extensive damage or personal injuries he is to remain at the scene and give all assistance possible. This procedure has been authorized by the Division of Maintenance after consulting with the state patrol.

In all major accidents, the driver should report the accident to his foreman or district office as quickly as possible, so relief trucks or other assistance may be supplied as needed.



Arrow MOBILE HYDRAULIC HAMMERS
ARE VERSATILE

Use ARROW MOBILE HYDRAULIC HAMMERS to drive shoring—posts—piling. Use them to break all types of paving—to cut asphalt—to compact trench backfills. *You'll save money and do a better job in less time.* ARROW MOBILE HYDRAULIC HAMMERS can be fitted with a wide variety of tools for special jobs. Exclusive creeper drive, with foot-controlled start and stop, is just one of the many money-making extras ARROW gives you. Get ALL the facts—learn why you get more for your money in ARROW MOBILE HYDRAULIC HAMMERS.

Write, Wire or Phone for complete information.

ARROW MANUFACTURING COMPANY
194 WEST DAKOTA AVE. DENVER, COLORADO

. . . for more details circle 186, page 16

***with* carbide bonded blades**

The new Carbide Bonded blade cuts a clean, constant width, easy to seal joint in *one pass*. Although field reports show Carbide blades last 2 to 3 times longer than all ordinary diamond blades, the cut virtually *remains the same width* throughout the life of the blade.

Write today for full information and prices.

Consolidated
DIAMOND TOOL CORP.
320 Yonkers Avenue, Yonkers, N. Y.
***Patents Pending.**
CONCRETE AND MASONRY CUTTING BLADE DIVISION

. . . for more details circle 205, page 16

Ask Cedarapids Built by IOWA Owners about Profit...

Someplace near you there's sure to be a Cedarapids plant working. Ask the owner about the profit potential of that plant! Ask the operator about maintenance and production cost!

We'll bet you get answers like these —

"We're keeping 28 dump trucks hopping on a 20-mile round trip haul, and still not operating at full capacity"— a Texas G40 plant owner.

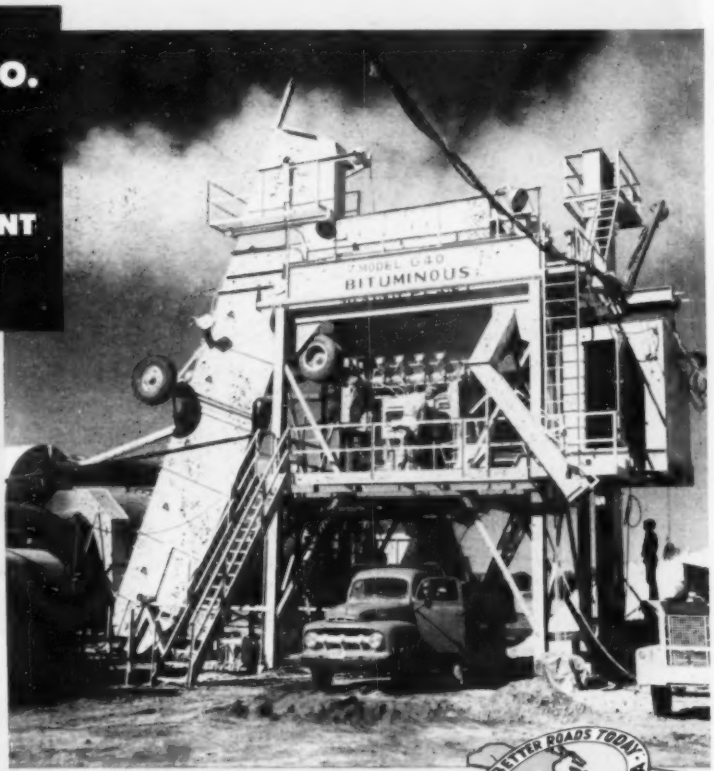
"On our Garden State Parkway contract, our G60 plant produced 180 tons per hour. We own two G60 plants"—a Baltimore contractor.

"We can outproduce anyone in this locality" —a Chicago asphalt plant operator.

"Our Model H15 is a well-constructed, sturdy plant. We're producing 50 to 60 tons per hour and meeting Highway Department specifications"—a Canadian producer.

Call your Cedarapids distributor for the location of the nearest working Cedarapids plant . . . then ask him to explain the Cedarapids features that will make more money for you.

PETER KIEWIT SONS' CO. uses MODEL G40 BITUMINOUS MIXING PLANT for Nebraska contract



This Model G40 batch type plant, owned by Peter Kiewit Sons' Co., is operating at Julian, Nebraska, producing material for Highways 73 and 75. It is one of the many Cedarapids asphalt and aggregate plants owned by this well-known company.

The Cedarapids G40 plant, taking up to 5000-lb. batches, is designed for jobs requiring around 120 tons per hour average production.

THE EXPANDED HIGHWAY PROGRAM offers thousands of miles of bituminous pavement contracts. *Get your share with low bids* made possible by the "high capacity — low cost" features of Cedarapids plants . . . batch-type or continuous-type, with capacities of 20 to 200 tons per hour. The complete Cedarapids line also includes portable aggregate plants, screens, crushers, feeders, conveyors, etc.

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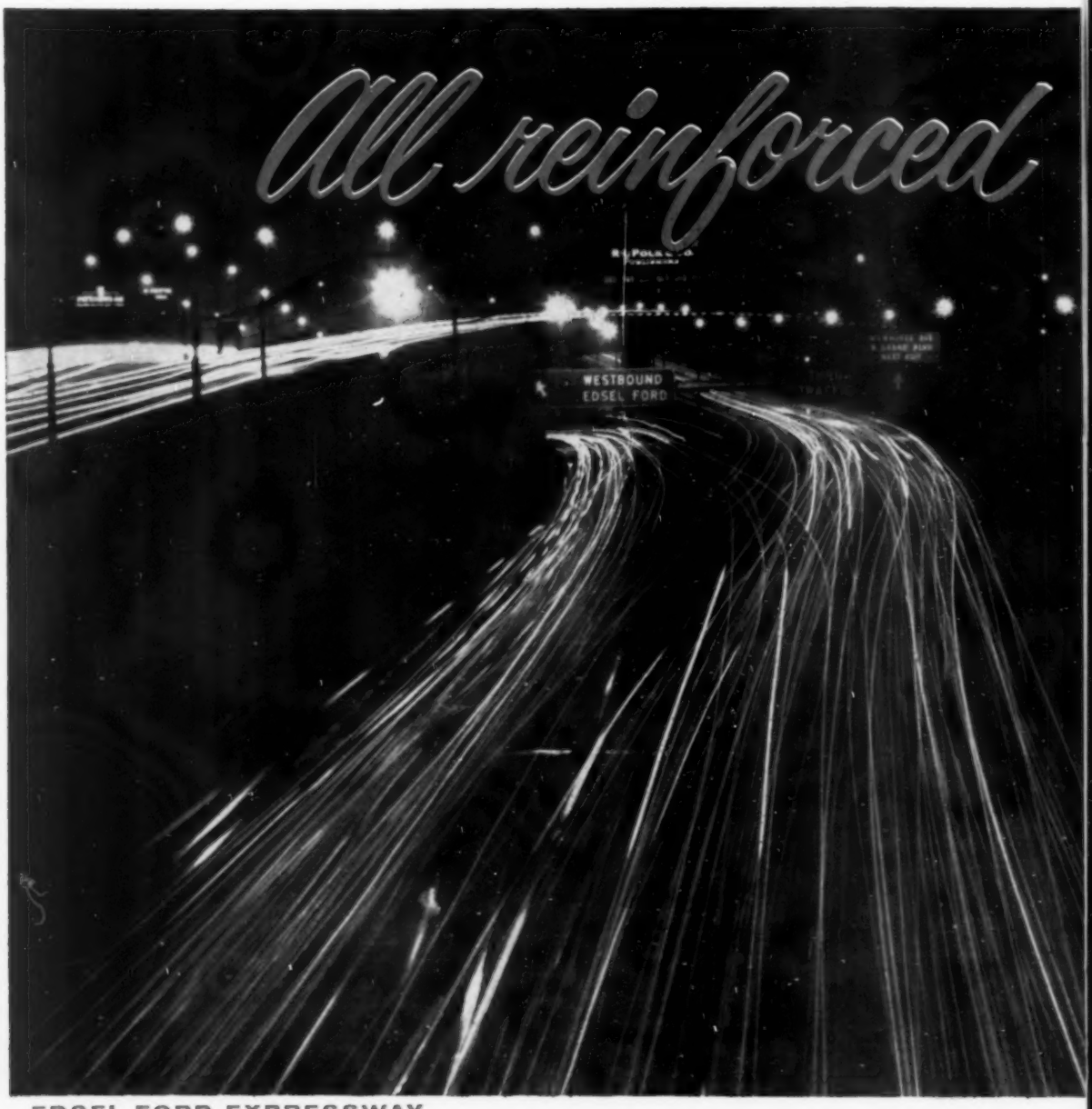
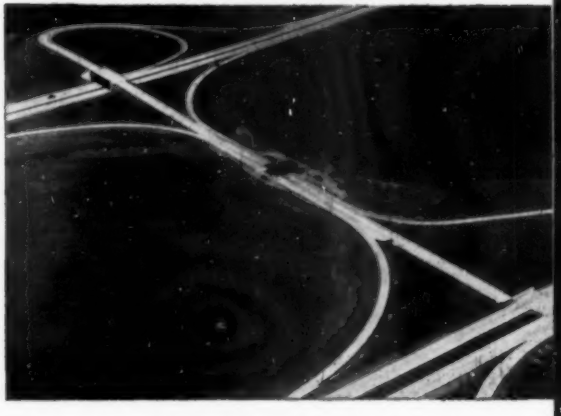
IOWA MANUFACTURING COMPANY
Cedar Rapids, Iowa, U. S. A.

. . . for more details circle 245, page 16



EDSEL FORD EXPRESSWAY
JOHN LODGE EXPRESSWAY

PENNSYLVANIA TURNPIKE



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EASY TO INSTALL. American Welded Wire Fabric comes in prefabricated sheets that can be placed quickly with minimum crews. It stays in place during pouring.

LOW COST. American Welded Wire Fabric has high-strength steel wire, electrically welded together for positive anchorage. The concrete slab is effectively reinforced with less steel than other types of reinforcement; so you have less steel to buy and less to handle. American Welded Wire Fabric keeps down maintenance costs, too, because it prevents destructive cracking, keeps roads smooth and safe.

VERSATILE. American Welded Wire Fabric comes in wide sheets for continuously reinforced concrete pavements in wire sizes up to and including ½" in diameter, at 2", 3", 4", and 6" on centers. The use of American Welded Wire Fabric increases the strength of the concrete slab by 30% over that of non-reinforced concrete.

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- ☐ American Welded Wire Fabric for Portland Cement Concrete
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- ☐ American Beam-type Highway Guard
- ☐ American Wire and Strand for Prestressed Concrete

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● Slope dressing in a difficult situation was done with a Gradall, using an extended boom.

"Back scratcher" dresses high, steep slopes

If an engineer had done his best to plan a highway project to include all possible difficulties in a short area, he could scarcely equal a stretch of 6/10 of a mile of the Topanga Canyon Blvd. in the San Fernando Valley.

In a distance of 200 ft. the job changed from a fill of 100 ft. to a cut of 160 ft. At one point the contracting firm, Lowe & Watson of San Bernardino, Calif., used a Gradall to good advantage, as pictured. It was a spot where the machine practically "stood on its head" to move the earth. An 18-ft. extension boom was needed to provide the necessary reach, and a ripper tooth was used to remove rocks from the slope. The machine's work was handled by Ed Waters, of Van Nuys, under a subcontract.

To further complicate the job, it was necessary to keep traffic moving during specified hours, and the contractor had to use a night shift to complete the work within the time limits of the contract.

The same machine was used also for handling dirt and stone in cutting down and finishing the face of the cuts and fills elsewhere on the project.

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NO TIME LOST!
BIG MONEY SAVED!

NO TIME LOST . . .
Because Southern Tire representatives pick up and return your tires at your job site after work hours, assuring no costly equipment downtime.

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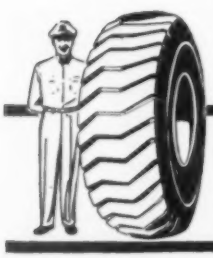
Because Southern Tire Retreads are guaranteed to equal new-tire mileage—at half the cost! Southern Tire's giant three-sectional molds (standard with U. S. Army) are fitted to the tire, instead of tire being cut down to fit mold. Finished retread has as much rubber in the lugs as a new tire and more undertread than any rock service tire.

CHOICE OF ROCK SERVICE, TRACTOR TYPES, OR RIB TREADS TO SUIT YOUR PARTICULAR JOB.



All Sizes from 1100x24 to 2700x33. Also new sizes 29.5x25 and 29.5x29. Call Your Favorite Dealer and Specify Southern Tire Retreads.

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POWER SHIFT
NO CLUTCH
TORQUE CONVERTER

HUBER-WARCO 5D-190 (195 H.P.)

POWER!

Tough grading jobs are handled easily and quickly by this 31,450 pound motor grader, powered by a 195 h.p. General Motors diesel engine.

PERFORMANCE!

An Allison Torque Converter protects the unit from shock loads while a full power-shift transmission — WITHOUT CLUTCH — permits quick shifts under full load without interrupting power flow from engine to load. A tail shaft governor automatically adjusts engine RPM to meet any load condition, at any speed set by the operator. Power sliding moldboard is standard equipment.

PROFIT!

These power and performance features have been combined to increase the working capacity of the 5D-190 and reduce costly down-time. With this motor grader it is possible to move more material, with fewer passes. This increased working capacity will add more profit to every job.

For more information write for Huber-Warco 5D-190 literature — Bulletin HWG-508 and Bulletin HWG-510.

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MARION, OHIO, U. S. A.

Road Machinery

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ROAD ROLLERS • MOTOR GRADERS • MAINTAINERS • GRINDERS

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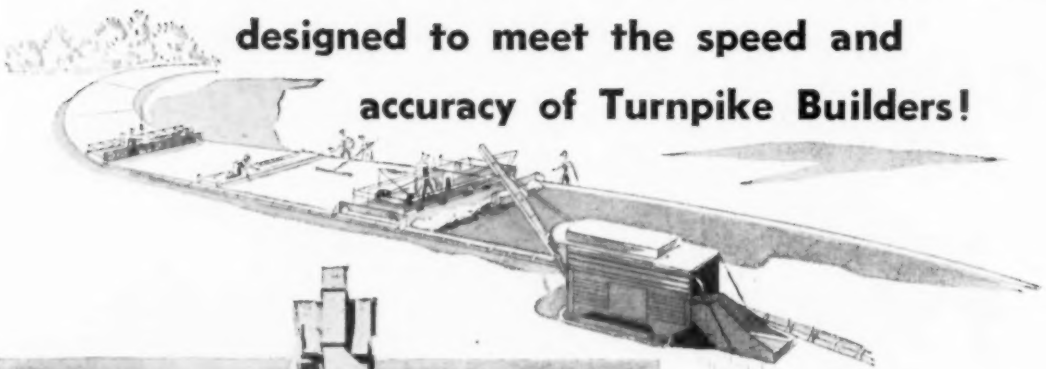
Strictly for Production

New Heltzel Batchmaster Plants designed to meet the speed and accuracy of Turnpike Builders!

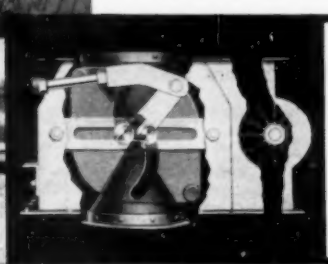


HERE are the paving plants the industry has been looking for! Big capacity Heltzel Batchmaster Production Paving Plants that have the portability, speed and accuracy to more than meet modern day work schedules and job specifications.

Let's look at the Standard E-3 Automatic Cement Batchmaster. Of flare leg design, to permit easier truck access, the plant has the exclusive Heltzel combination gravity vane cement charger (below) that means the fastest, most accurate batching yet possible. Designed for fast, easy dismantling, it easily comes within the dimension limitations for over-the-road hauling. The plant itself will hold up to 609 bbls. of cement. Add Heltzel's high speed recirculatory system and this capacity can be expanded to over 1600 bbls. Smaller size recirculators also available.

A perfect mate to the E-3 is the Type 200 Batchmaster aggregate plant. It is a sturdily built, portable plant that holds a full 200 tons. Yet it can be quickly dismantled into four sections for transporting from one location to another. It is compartmented to suit requirements. It will carry the largest batchers made, including Heltzel's exciting new electronic unit.

If your program for this year calls for the placement of a large quantity of concrete, these plants will save their initial cost in short order. Before you buy equipment, let us show you their many advantages. And remember, it costs no more to own Heltzel Batchmasters—so why not operate with the finest.



The amazing Heltzel Combination Gravity Vane Cement Charger that permits cement batching with a speed never before attained, to an accuracy that has rewritten the record books. It's standard equipment on all automatic Batchmaster plants.

THE HELTZEL

Paving!

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HELTZEL

BATCHING PLANTS

Heltzel is one of the nation's leading proponents of automatic and electronic batching. Let their sales engineers show you the latest in these modern day batching techniques.

STEEL FORM AND IRON COMPANY

78000 THOMAS ROAD — WARREN, OHIO

. . . for more details circle 234, page 16

New DW21 makes 15 round trips per hour on 1200-foot round-trip haul in Montana

On Tenth Avenue, South, in Great Falls, S. Birch & Sons Construction Co. is rebuilding four miles of by-pass connecting U. S. Highways 87, 89 and 91. The $454,000 contract calls for widening the route from two lanes to four lanes, divided. Completion of the one-year project is scheduled for August, 1956.

A CAT* DW21 Tractor (Series C) with a No. 470 LOWBOWL Scraper is shown here loading material from the old road surface. It makes 15 round trips per hour over a haul distance of 200 yards each way. The rig has done 90% of the earthmoving on this job, according to C. F. Graves, foreman. He says: "It's the best piece of rubber-tired equipment I ever saw. It does a good job of ripping up the old oil surface, and in dirt it can do a pretty good job of loading itself."

Guy Haney, the superintendent, adds: "Our new DW21 is a honey. It has fine power and traction and the No. 470 definitely loads much easier than any other scraper we ever used."

Wherever these new units are in action, that's the kind of reports that come in. The DW21 (Series C), with its 300 HP (maximum output) Turbocharged engine, is perfectly matched with the No. 470 LOW-BOWL Scraper. The lower, wider bowl design loads more earth faster and with less effort. That means consistently better cycle times and bigger production.

If you haven't seen the DW21-No. 470 unit at work, ask your Caterpillar Dealer for a demonstration right on your job. Hold a stop watch on it and prove for yourself that it will outwork any comparable wheeled rig.

Caterpillar Tractor Co., Peoria, Illinois, U. S. A.

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NAME THE DATE... YOUR DEALER WILL DEMONSTRATE

. . . for more details circle 197, page 16

HOW A BIG-CITY CONTRACTOR

Maintains and Renews His Equipment

Slattery Contracting Company, of foundation and parkway fame, finds it profitable to operate one of the largest and most complete contractor-owned mechanical centers in the New York City area.

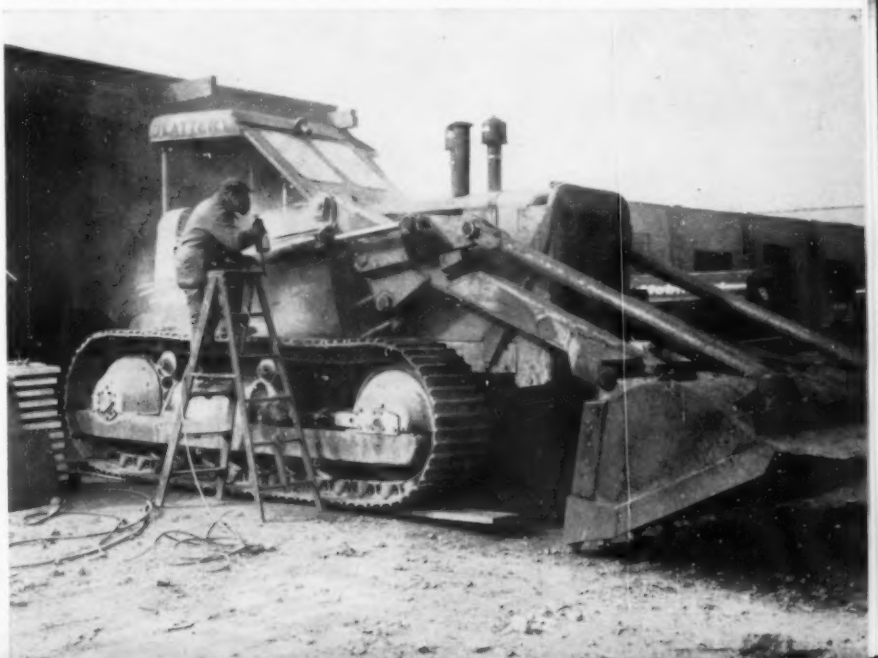
THE name Slattery is familiar to New York City's millions, who see it emblazened in gold letters on big ten-wheel dump trucks and painted on cranes, shovels and compressors working on streets and utility repairs and in skyscraper basements.

And the name, too, is familiar among fellow contractors — as representing a firm which puts a premium on good equipment and its proper care. The Slattery headquarters shop is considered by some equipment supply men to be one of the best contractor layouts in the New York City environs. This review will take the reader on a picture tour of the place.

Slattery Contracting Co., Inc., of Maspeth in Queens, Long Island, tackles expressways, sewers, foundations, dams and water projects. Recently it took a $7½ million piece of the New England Thruway. It figured in the joint venture which has just completed New York City's new $35 million convention hall. The Slattery group also includes Slattery Rock Corporation and Slattery Foundation Corporation.

The operations, being concentrated heavily in and around New York City, lend themselves to a centralized equipment management. For this reason the company built its present modern 20-acre plant at Maspeth just across the East River from mid-town Manhattan. Significantly, and somewhat

● Semi-outdoor paint shop, back in the yard, where Slattery's overhauled equipment gets its final touching up with the DeVilbiss spray gun.



Behind the Lines with Successful Contractors

Main Shop More than just a modern building, this shop is one of Slattery's competitive tools. Complete overhauls are done here in a year-around operation.

Metal Working In this corner is the blacksmith work, bar bender, pipe cutter, metal saw, torch equipment. Slattery's men here are fabricating lifting hooks for use in picking up heavy manhole units.

Stock Room A carefully restricted inventory of parts and supplies needed by the mechanics and servicemen is neatly stored here.

unusual in the East, the shop and yard are not on any rail line. Equipment movement to and from jobs is done on rubber. Flatbeds loom importantly in the company's operations, and part of its stock-in-trade is an intimate knowledge of bridge headrooms, axle load limitations, turning radii of equipment, and of routes usable for critically large, long or heavy machines.

Large Equipment Spread

● *Slattery's Fleet*. The particular pride of the company therefore is its fleet of 30 to 35 10-wheel dump trucks (Mack, Sterling, etc.); and its 5 trailers (Rogers, etc.). The firm currently has something like 14 truck cranes (Lorain, Northwest, Koehring); 9 crawler cranes and shovels (Lorain and Northwest); 14 heavy tractors (Caterpillar and Allis-Chalmers); 8 tractor-shovels and front loaders (Michigan, Cat, Allis-Chalmers); 17 heavy and 10 small compressors (Ingersoll-Rand, Chicago Pneumatic, Jaeger, LeRoi); 2 scrapers (Cat DW 21); 8 rock trucks (Euclid, Tournarockers); 2 motor graders (Cat, Adams); and scores of related units, not to mention two complete concrete paving outfits (Koehring pavers).

The company finds it profitable to

Steam Cleaning Large-capacity Malsbury steam cleaner is used daily to clean engines, transmissions and other parts during overhauls. Friday and Saturday, to clean trucks for coming week. Structure at right houses water hydrant.

cranes and lesser equipment. Specialized engine overhauling equipment is located here, as is long bench with more grinders, brushes, drills, etc. In the corner, high out of the way, is a pair of I-R shop compressors. Alemite lube equipment, Lincoln and Westinghouse welding units, and a Balcrank lube oil dispenser round out the picture, with the modern touch of fluorescent lighting.

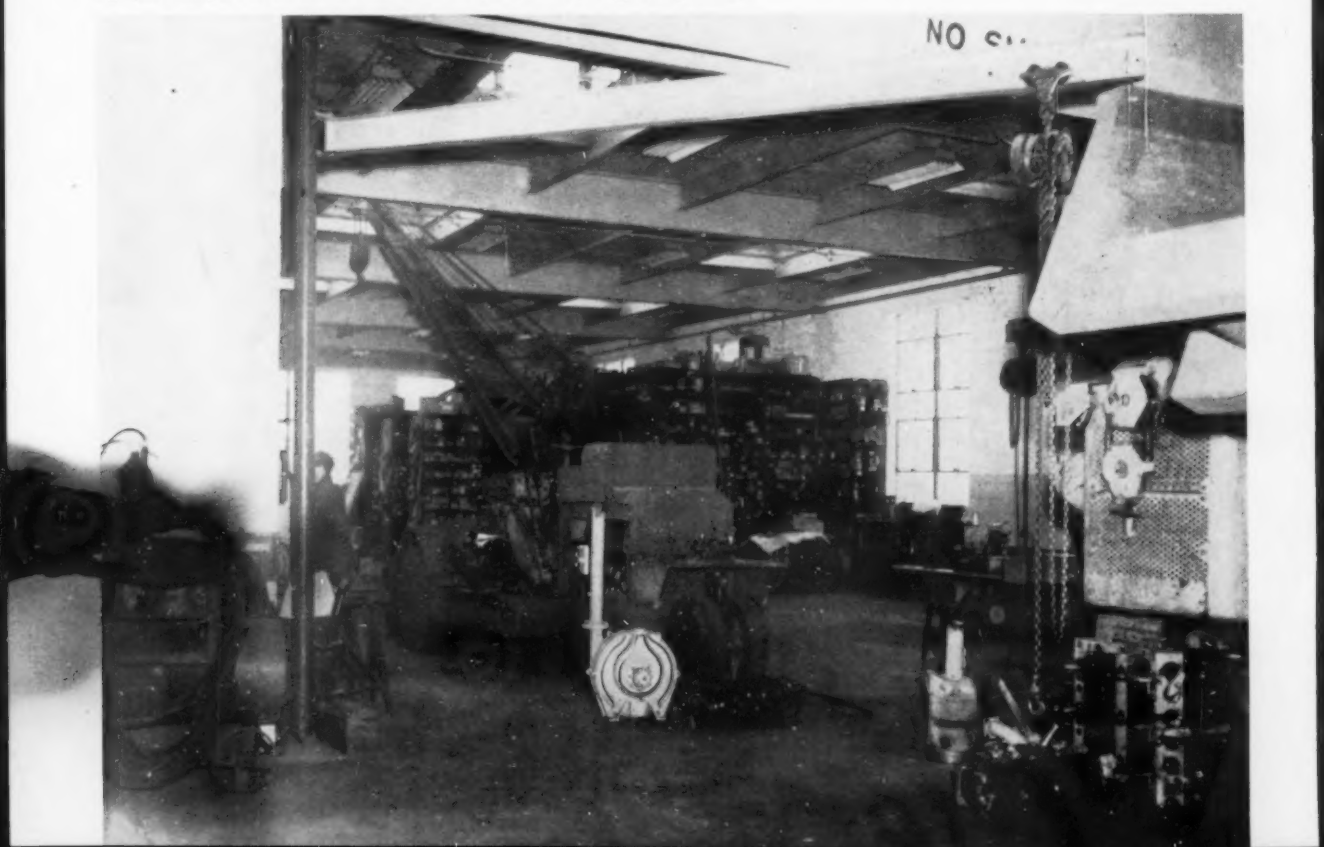
Midpoint between the two bays are mounted two heavy Yale chain hoists on swiveling cantilevered rails, for picking up and transferring engines and heavy parts. This pair of hoists reaches well into both bays.

Also in the rear bay is storage space for jackhammers and other light equipment and tools, and stacks and bins for considerable parts and supplies. This inventory however is carefully slimmed down, since distributor houses can make quick deliveries of many parts needed.

• *Big Yard.* The spacious stone-surfaced yard has room for outdoor storage of several acres of equipment. Fringing on it are semi-open storage sheds, and out there also is the semi-open paint shop, so designed as to permit open conditions yet shelter from the weather when needed. A De-Vilbiss paint spray outfit is kept busy the year around.

In the yard also is the company's big Malsbury steam cleaner. This machine with its electric power and 900 gal. per minute (680,000 btu per hour) capacity, is used almost daily on engines and parts but is used mainly on week-ends on truck washes.

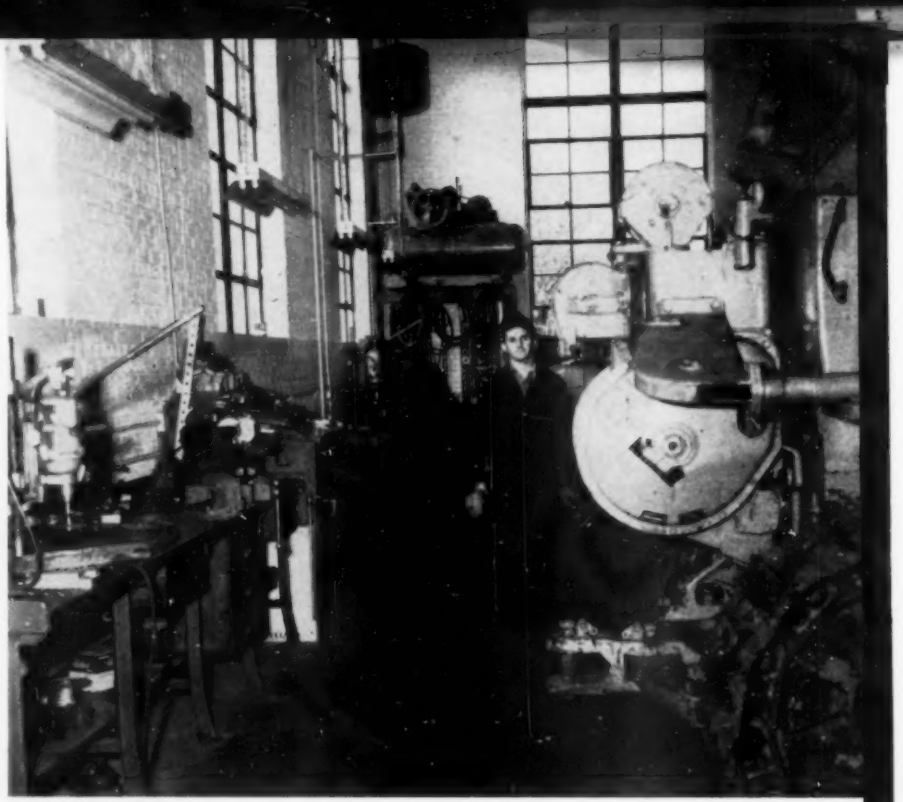
Swiveling Hoist Mounted on an arm swing from a wall post, this Yale chain hoist reaches out into both equipment bays. A similar unit mounted on other side (to right of picture)



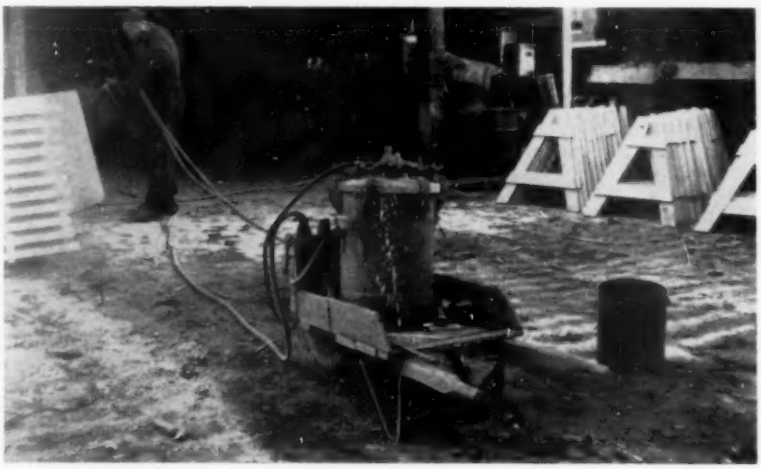
own a major part of its equipment, but does rent for short periods in emergency. On paving jobs, the practice is to use one company-owned paver, with a rented paver as a standby or second unit. Slattery owns no truck mixers, but buys large yardages of ready mix from such commercial sources as Transit Mix Co. of New York.

● *Headquarters Buildings.* With this brief outline, let us look at the company's home base. In 1948 it erected a modern brick and steel office building with a garage wing for automobiles and limited truck use. Adjacent to this building is the main shop, built also to the company's specifications. This L-shaped structure has two bays. The heavy machinery bay, 60x 100 ft. by 24 ft. headroom, can accommodate overhauls of two tractors, two shovels or cranes, and miscellaneous work simultaneously. A 20-ft.-high door can be negotiated by the largest shovels. This bay has a bench grinder, drills, an area for welding and blacksmithing work, and assorted floor equipment including a Manly hydraulic press, Kalamazoo metal saw pipe cutter, Sioux dolly-mounted grinder unit, other hand grinders, an acetylene cart, work bench with bar bender, truck service hoist, and mechanics' tool cabinet.

The second bay, 50x100 ft., with 20 ft. headroom and large door, affords overhauling of medium-sized

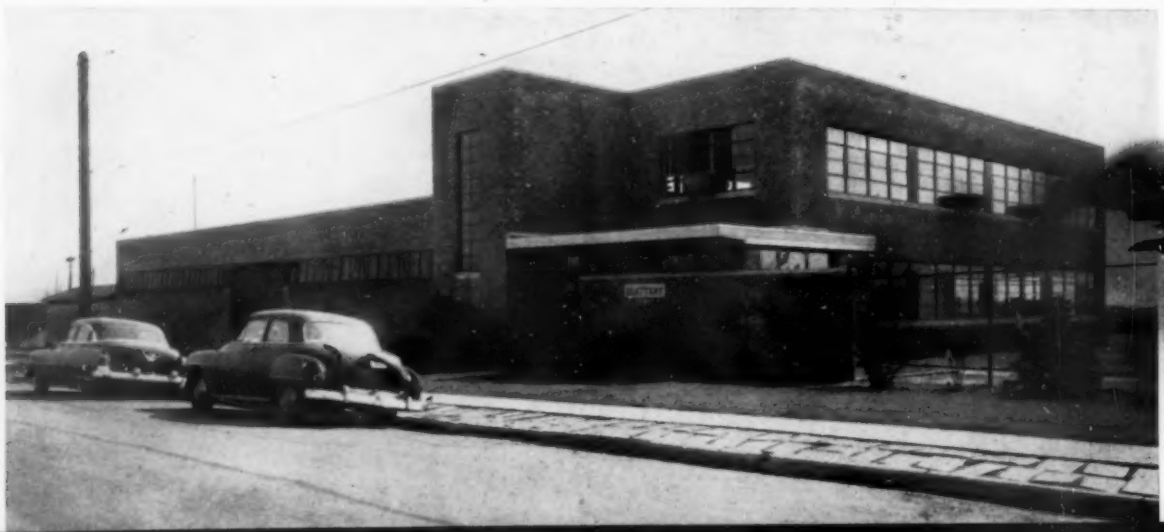


"Heavy" Bay Tractors and other heavy equipment are reconditioned and serviced from this long bench. Note shop compressors, mounted above a parts bin cabinet. Also note clean floor.



Paint Shop Another view of lean-to where barricades as well as equipment get painted to meet job specifications.

Headquarters This modern office building is the nerve center for the Slattery operations. Engineering, estimating and bookkeeping staff here. Wing at far end is the auto and truck garage.



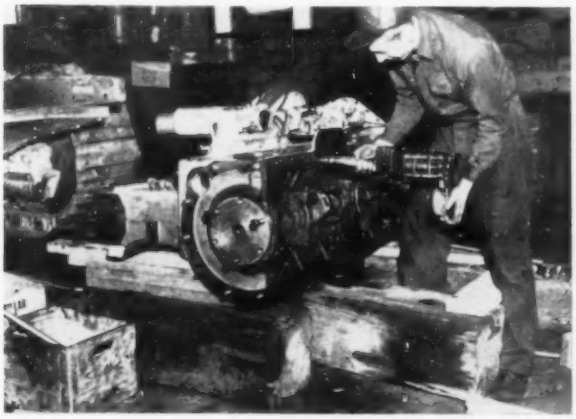
Resourceful Mechanics

Following are a few additional features, and a description of some of the activities in progress at the time the accompanying photographs were taken.

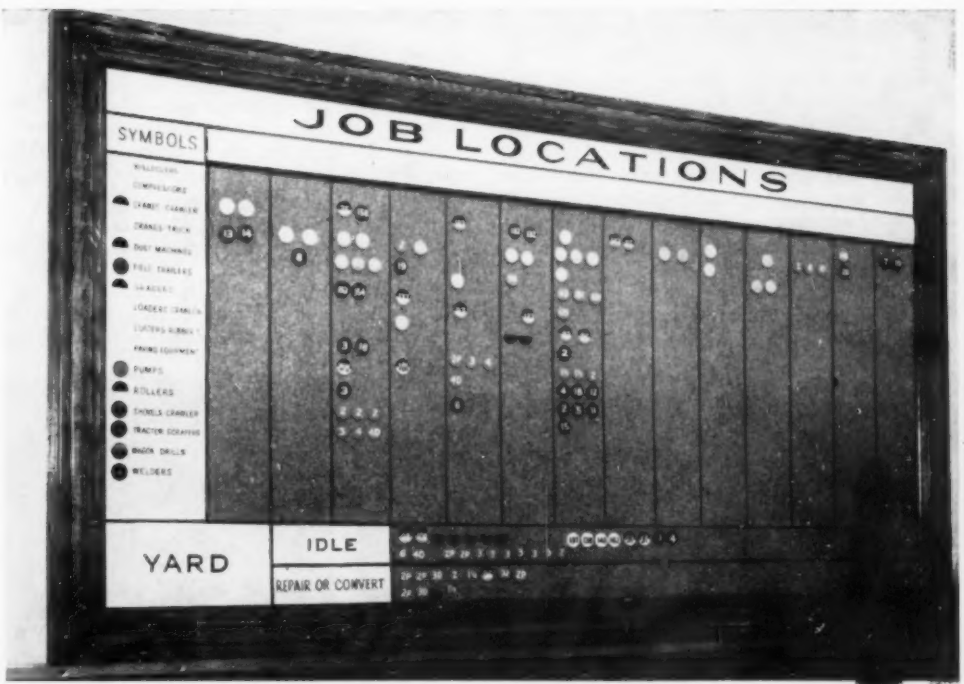
1. *Engine Warmer.* Despite the fact that most of the company's trucks are parked outdoors at night, winter morning starts are made without delay and unnecessary labor, thanks to a series of plug-in points for electrical transmission warming elements. The plugs are located in a pipe along the back wall of the garage building (see photo).

2. *Cable Storage.* One of the neatest cable storage stations is seen in Slattery's garage room. Three to five large reels of wire rope are stored on racks, for convenient feeding out to a

Cable Cutter A Peel Hydrashear being used to neatly cut cable lengths, a much appreciated unit. Note how rope is mounted on spindles, ready for dispensing.

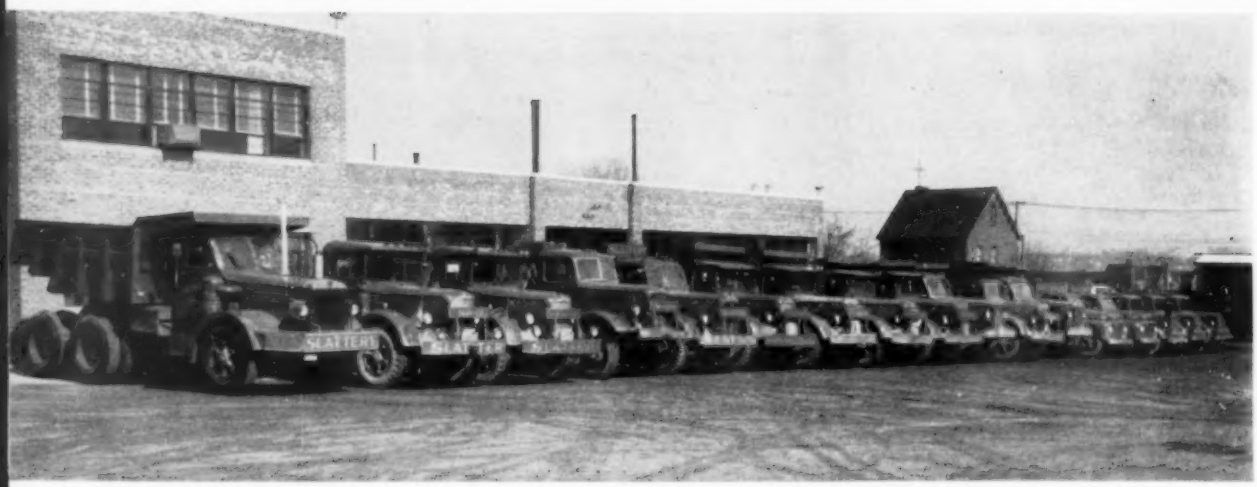


● Additional glimpses of the "heavy" room — Fitting an oil pump on a D8 engine, and greasing a tractor before sending out.



Dispatcher's Chart

By means of the board shown here, Gerald Saunders, purchasing agent and shop office manager, keeps track of a hundred major equipment units in the field.



Out in the Yard Some of Slattery's Mack trucks, steam cleaned and serviced and ready for the week's work ahead. Below is shown the firm's "yard bird," a Hughes & Keenan crane.

Hydrashear cable cutter. No mashed ends to the rope and considerable footage saved per year, not to mention prevention of finger cuts from sharp frayed wires.

3. *Truck Support.* Instead of flimsy oil barrels placed under truck rear-ends in the shop, to relieve the jacks during overhauls, the shopmen have fabricated several heavy cylindrical units. These are 24 in. high and made with ¼ in. steel, and have a welded plate top and a stout lifting bar. The 1,100 lb. units are handled by the chain hoists, or by any crane that happens to be on the floor. This is one of numerous safety devices developed by the shop crew.

4. *Fire Extinguishers* are spotted all over the place, and also on some of the trucks. The men are kept conscious of the fire hazard, and know how to act in emergency.

5. *Cleanliness.* This is quickly noticeable around the shop and garage. The freshly painted rubbish cans spotted on the shop floor are hints that good housekeeping is expected. Tools and parts are kept up off the floor when not in use.

6. *Modification.* Slattery's men like to apply ideas for improving equipment or fitting it for the company's specialized needs. For example, the boom lengths of several wagon drills were being changed. Lifting brackets had just been welded on several skid-mounted light plants after overhauling, so they can be set quickly on and off the trucks without unnecessary labor.

Major modification is sometimes undertaken. A Sterling truck with 14-yd. rock body was rebuilt recently, its single rear axle being replaced with a Timken off-road type dual rear axle

Modifications Example of special shop-built rear fender, adapting a Mack truck for trailer operation. (At Right): a big Sterling equipped with new off-road dual Timken rear axle in place of original single axle, and new rock body built in the company's shop.

Quick Starts Outdoor wall plugs, for hooking up electric transmission warmers for trucks stored outdoors in cold weather.

"Ideas" One of numerous labor-saving, cost-cutting ideas — smaller equipment units fitted with lifting frames. A pair of overhauled light plants, shown here.

in order to step up the truck's load capacity. New fenders have been fabricated and welded by the Slattery shop crew to fit this and other modifications, including adaptation of several Mack truck tractors for hauling flatbeds.

Another Mack truck was recently modified by lengthening its chassis frame, installing a new 200 hp Cummins diesel engine, and changing the gear ratio of the transmission and rear end. This unit also has its own Slattery-built 20-ton rock body with St. Paul hoist.

● *Preventive Maintenance.* The preventive routine is also tailored to the Slattery operations. The shop works Saturdays, so that equipment can be gone over with least interruption to job operations during the week. Many trucks in the area are brought in Friday night and lined up in the yard, where they are steamed, greased, given oil change, and the full preventive routine practiced covering inspection of brakes and other parts. Inspection tickets show what special work is required, and mechanical trouble is nipped in the bud.

● Charles Pretsch, who bosses the Slattery equipment maintenance.

Some trucks come in on other nights for various reasons, and here again a slip is left showing what mechanical attention is needed, and the shopmen get quickly at it. To accommodate such needs from the field, two mechanics work the 4 to 12 pm shift, and two the midnight to 8 am shift. The shop staff, which runs rather uniform throughout the year, usually includes 7 mechanics, 3 helpers, 2 blacksmiths, 1 yard foreman, 3 laborers, and the superintendent and shop office manager. With this compact crew the company sends virtually nothing out, but does its own general overhauling including engines, as well as day-to-day fixing and periodic work on modifications and special ideas. The firm does not have a tire shop or storage, but finds it profitable to work through a tire service specialist. This firm, Jerry's Tire Service handling Goodyear and Firestone tires, works in a relationship which has become quite typical with large contractors today. On call at any time, it replaces worn or cut tires and does all the handling involved.

Each tire issued to Slattery is branded with a serial number, and books are kept on its cost and job performance.

Shop Organization

Coming back to the Slattery shop organization, the policy of good equipment care goes right to the boss's desk. President James Slattery knows equipment and the value of good maintenance, as do such executives as George Benisch, outside superintendent, and other staffers. Chief credit for the company's fine mechanical reputation is due to Charles Pretsch, master mechanic, who has been given a wide latitude in building up his staff and facilities. He in turn will instantly credit the good efficiency and morale around the place to his men, who are given the opportunity to earn high, steady pay.

One last little detail. The trucks when reconditioned are sent out with gold-edged lettering of the name Slattery, and gilt edging as well as a paint job.

It could be that this is good psychology for the operators as well as good public relations all around.

Cleanliness Shopmen are kept reminded of the policy of neatness by such devices as this painted barrel. Barrel alongside is for metal scrap materials. Another nearby is for waste paper and refuse.

Traffic death rise is called "Emergency"

The National Safety Council, recently publicized as a "traffic accident emergency," the fatality rate on the highways. The figures for March were the highest in history of that month, with a record 39,969 projected annual death rate.

March was the 13th consecutive month of increased traffic deaths. The toll for the first three months of 1956 rose to 8,590, second highest first-quarter total on record — succeeded only by the 1927 figures.

Editorial

THOUGHTS AS WE FACE THE GREATEST PEACETIME CONSTRUCTION JOB IN HISTORY

The "Blueprint" which is unrolled on your desk in this issue of ROADS AND STREETS is something of a shocker. It was meant to be because of the complacency which still pervades a few state highway departments and more than a few city halls on highway and street planning. Should Congress pass even a scaled-down version of the "grand plan" federal highway program this summer, the expansion confronting state and municipal agencies will be comparable to that faced by the Corps of Engineers in Pearl Harbor days.

"The impossible takes a little longer," was the motto of the military engineers. Under spur of war they expanded ten-fold and performed billions in construction. Can the highway fraternity do something comparable if and when it suddenly has the reconstruction of the Interstate System dropped into its lap? Our industry which has boosted highway construction volume for 10 successive years since the war, and doubled it since 1952, must step construction sharply higher — yet do so on an orderly, long-range, carefully programmed and engineered basis.

We, too, have an emergency to spur us into action. It is the traffic dilemma with its 40,000 annual fatality rate and millions of dollars daily economic loss from transportation inefficiencies. No industry outside of defense ever had such a challenge, or such an opportunity, as that which will confront us if Congress votes the program currently being debated. The first two years in this program will be the critical ones because of the advance work to be done.

● As detailed in the accompanying Blueprint, highway leaders are in agreement that these problems must have top priority:

First, need studies must be made beginning at once in states which haven't yet taken this basic step. These should be comprehensive, and should do a thorough job in urban areas, where an amazing lack of essential data exists. Older studies should be brought up to date.

Second, an over-all highway plan must then be developed within each state, based on needs, and a priority program of projects adopted — so that route, location and design studies can be made and work on construction plans then begun.

Third, highway laws must be revamped to give the working tools. Not every state today has clear laws and court decisions required for swinging quickly into the gigantic job of right-of-way acquisition, involved in interstate and urban construction on new locations. Not every state has insured the airtight legal status of the principle of access control, so essential to protect costly new expressways against encroachment.

Fourth, states and cities must enter into new and more effective working relationships, so that the neglected urban phase of the nation's arterial system — and the new special urban facilities due under the federal program — will receive top-level attention. The day when rurally dominated legislatures and highway departments can shortchange such cities as Chicago, Detroit, St. Louis and other traffic-congested population centers is coming to an end. A big chunk of the proposed $51.8 billion rightfully is aimed at constructing new express segments into, through and around cities.

● Here in the cities will be centered the knottiest problems of planning, location, design, right-of-way procurement and construction. Highway departments will need strong urban divisions. Cities must contribute new leaderships along with urbanized counties.

Fifth, the personnel problem in the highway departments must be given new recognition, and broad and intensive programs set up to find more engineers and supporting aids and better utilize them. One AASHO leader has suggested that this effort should be headed by a deputy state highway engineer, with super-status. Specialized enlistment and training personnel will get down into the high schools, work more closely with colleges, foster more scholarships, step up in-service training, appraise and help apply new labor-saving techniques — and when necessary seek legislative help to make highway department careers attractive and satisfying.

While money alone isn't the whole inducement to attract and hold engineers in highway work, several billions of this fifty billion dollars would be well spent in the form of higher pay scales, extending through all grades.

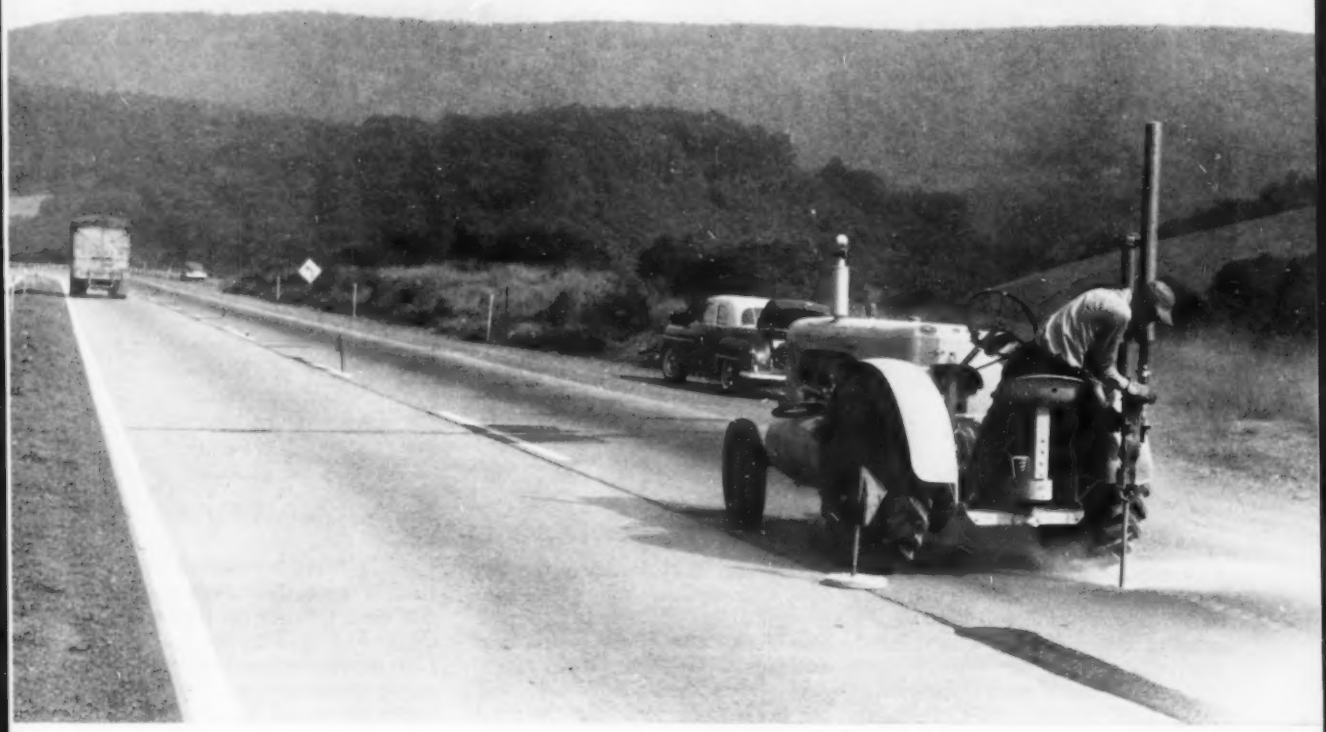
Sixth, what about administrators and managers? This would seem to be the real bottleneck in a sharply expanded highway program.

As we have said before on this page, in investing billions of public funds, we must have top leaders of $100,000 per year caliber. Able, alert new headquarter division chiefs, district engineers, and career scientists, must be developed from the ranks to replace the ageing veterans who now are carrying the load and must retire soon. This management staff for a large highway department should be the counterpart of a corporation team — consisting of men with integrity, sense of public duty, and enthusiasm who can bring our complex technology into full play and with maximum efficiency.

These, then, are our chief problems, summed up by this editorial staff at a time when such stock taking is felt to be so important. Technical knowledge we have in abundance. Material and equipment shortages will fade when industry is assured of a long-time market. Contractors are ready and waiting. The big task is to get out the construction plans.

Even if Congress should fumble again, and postpone the inevitable for a little longer, the delay will merely give the highway and city departments a breather.

— *Harold J. McKeever*



Underseal Work on Penn Turnpike Done 45% Faster with One Tractor-Compressor and Drilling Attachment

. . . not only is pavement drilling faster, but costs are lowered through savings in equipment and manpower

One self-propelled Le Roi Tractair has replaced a parade of drill runners and hose-drag helpers struggling along behind truck-towed compressors on the busy Penn Turnpike. This tractor-compressor increases the speed of pavement drilling by 45% on asphalt underseal work. At the same time, it provides a tremendous reduction in equipment and labor costs.

The old method of pavement drilling required a large crew with hand-held pneumatic drills, another crew to drag hose, and two or more truck-towed compressors. Work was slow and expensive. Often underseal crews had to stand around waiting for the drilling operation. And heavy Turnpike traffic was tied up behind the project.

A money- and time-saving solution was found in the Le Roi Tractair, operated by one man. It's a combination 42-hp wheel tractor and a 125-cfm air compressor that can be equipped with a wide variety of mounted attachments and air tools. In this instance, the Le Roi-Cleveland Trac-Jac is the attachment used on the Tractair. The Trac-Jac is set vertically at right angles to the pavement where it swings easily so that the drill point can be centered over location marks made by surveyors. Bits bite into concrete rapidly because the Trac-Jac has a quick-acting air feed.

On this job, the Le Roi Tractair with Trac-Jac attachment drills 100 holes per hour, 12 inches deep through concrete with an average hole spacing of six feet. This "self-contained" unit is all that is needed to drill pavement faster at much lower cost. It also permits traffic to proceed during work without serious interference.

There are many ways that the self-propelled Le Roi Tractair can increase production and cut costs. It can do other highway jobs, and countless tasks in light and heavy building. Many efficient attachments are available, plus dozens of Le Roi-Cleveland Air Tools. See your Le Roi distributor.

LE ROI Division of Westinghouse Air Brake Co., Milwaukee 1, Wisconsin, manufacturers of Cleveland air tools, Tractair, portable and stationary air compressors, and heavy-duty industrial engines. Write us for information on any of these products.

T-42

. . . for more details circle 251, page 16

Now there's a great automatic for whichever Chevy truck you

Famous Chevrolet ***Hydra-Matic,*** or all-new ***Powermatic,*** provides easy, safe automatic driving that's tailored for your truck!

Pick *any* Chevrolet truck . . . and you'll find there's a modern automatic transmission to make your hauling easier, safer, and more profitable than ever!

For instance, if your choice is a Series 3000 or 4000 truck, there's ***Hydra-Matic.*** This modern automatic transmission eliminates manual gear shifting, gives you the ease of no-clutch hauling. It saves you maintenance money, too, because the hydraulic coupling protects universal joints, rear axle gears and shafts, rear tires and engine parts from shock loads. And, by automatically selecting the proper gear ratio for the road and load, ***Hydra-Matic*** gets you where you're going faster—saves you time!

Or, if your job calls for a 5000 through 10000 Series Chevy, there's exclusive ***Powermatic***—the first automatic transmission designed especially for big trucks! Unlike conventional or semi-automatic transmissions, ***Powermatic*** *works for you all the time.* Six fully automatic forward speeds and a torque converter virtually eliminate manual gear shifting on hills! A revolutionary "retarder" assures

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CHEVROLET NEW CHEVROLET

Anything less is an

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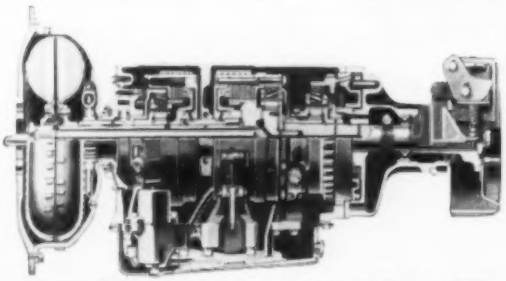
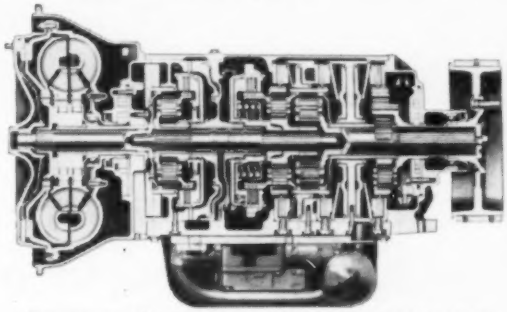
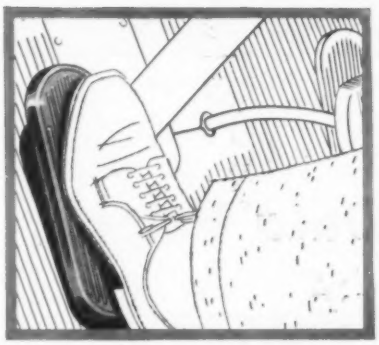
transmission choose



Hydra-Matic—optional in Series 3000 and 4000 trucks—brings new ease to tough jobs, cuts hauling time and maintenance expense.



Powermatic—optional in Series 5000-10000 models—assures the easiest, safest big-truck operation ever known! It's a Chevrolet "first."



Exclusive *Powermatic* Retarder makes downhill hauling safer, saves brakes! Most hills can be descended without touching the brakes . . . and most normal slowdowns can be made by the retarder alone!

safer downhill hauling, far less brake wear. You'll make better time through traffic because all shifts are "power-on" shifts. And ***Powermatic*** is designed to aid top-notch economy on the highway!

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This wide selection of advanced transmissions is one more reason why Chevrolet trucks serve you better, one more reason why you should see your Chevy dealer soon! . . . Chevrolet Division of General Motors, Detroit 2, Mich.

**Optional in 5000 through 8000 Series models, standard in 9000-10000 Series models.*

NEW MIDDLEWEIGHT CHAMPS!

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. . . for more details circle 224, page 16

● Engineers on Test Fill No. 2 near Lawrence, Kansas, taking compaction tests after one pass of the 50-ton rubber-tired compactor (seen at the far right).

Field Tests and Geological Data Helped Plan Turnpike Grading

By Ralph E. Skoog

Geologist and Soils Engineer for the Kansas Turnpike
Howard, Needles, Tammen & Bergendoff, Consulting Engineers, Topeka

Moisture was a problem with the contractors in pushing 46,000,000 cubic yard grading job on the 236-mile Kansas Turnpike. Test fills and use of geological data played an important role in determining procedures.

TWO hundred and thirty-six miles of grading totaling 40,000,000 cubic yards of common and 6,000,000 cubic yards of rock excavation — this was the formidable task for which surveys, specifications, plans and estimates had to be prepared and which contractors had to tackle and complete in an 18-month period for the Kansas Turnpike. These quantities challenged the engineers and the construction industry when the Kansas Turnpike Authority sold $160,000,000 of turnpike bonds on October 14, 1954. The turnpike, when paving is completed late in 1956, will connect Kansas City, Wichita, and the Oklahoma border directly north of Oklahoma City.

Engineering organizations had previously been tentatively assigned to definite sections for plans and construction control, in anticipation of the financing which would enable the Authority to construct. These firms wheeled into action, preparing plans at such a rate that the first letting of 17 miles of grading through some of the roughest terrain was held within less than three months, and the remaining 219 miles in the next two months. Substantially the entire 236 miles of grading was under contract by March, 1955.

This $28 million worth of construction plans in 44 separate contracts was as far from being complete for the engineers as it was for the contractors during the initial stages of grading operations. The specifications for compaction of earthwork were of a nature somewhat more strict than those with which many of the contractors had worked on previous contracts. These specifications were considered necessary because of the high standards of performance required of the turnpike and the necessity to hold maintenance to an absolute minimum. They were also influenced by the nearly complete continuity of construction progress, with paving to be placed immediately as the grading is completed in many cases.

● *Basic Specifications.* The basic specifications are that the rock is to be placed in lifts not to exceed 2 ft. and the common in not more than 6-in. compacted lifts, unless the contractor clearly demonstrates his ability to achieve uniform acceptable density in thicker lifts.

The moisture and density requirements call for 100% of AASHO standard compaction density, achieved between plus 2% and minus 2% of the optimum moisture content in the top 18 in. of the subgrade; 95% of maximum density within the same moisture

limits between 18 in. and 3 ft. down from top of subgrade; and 90% density compacted between optimum moisture plus 2% and minus 4% in the embankment below.

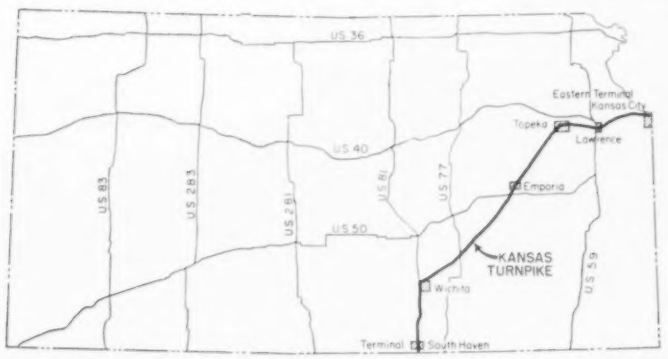
In addition to the foregoing requirements, the contracts specify that the top of the embankment is to be rolled with three complete passes of a 50-ton roller after being compacted acceptably to test for "soft spots" in the fill and the same to be accomplished after completing the 95% zone and a third time on the top of subgrade. Three passes of the 50-ton roller are required on each 2 ft. of rock fill.

The specifications for the classification of rock and common excavation are based upon the concept of the natural weathered state of the material, and are not written to include criteria based upon equipment type or method of excavation.

This classification has been in force under the Kansas Highway Commission Standard Specifications for about 15 years and has proven very satisfactory. It is, as are all methods of classification, not without its limitations particularly for use by construction men who are unfamiliar with the field application of the specification.

Subgrade Specifications

In addition to the specifications covering the placement and compaction of the embankment, the subgrade specifications for the preparation of low fills are in force. These specs call for scarifying, bringing to an acceptable moisture content and recompaction of natural ground falling between 18 in. and 3 ft. from top of subgrade. They include as a pay item the removal of the top 12 in. of natural ground; scarifying and recompacting of next 6 in. below; and replacing and recompaction of the removed material to 100% when the top of the subgrade lies within 18 in. of natural ground.



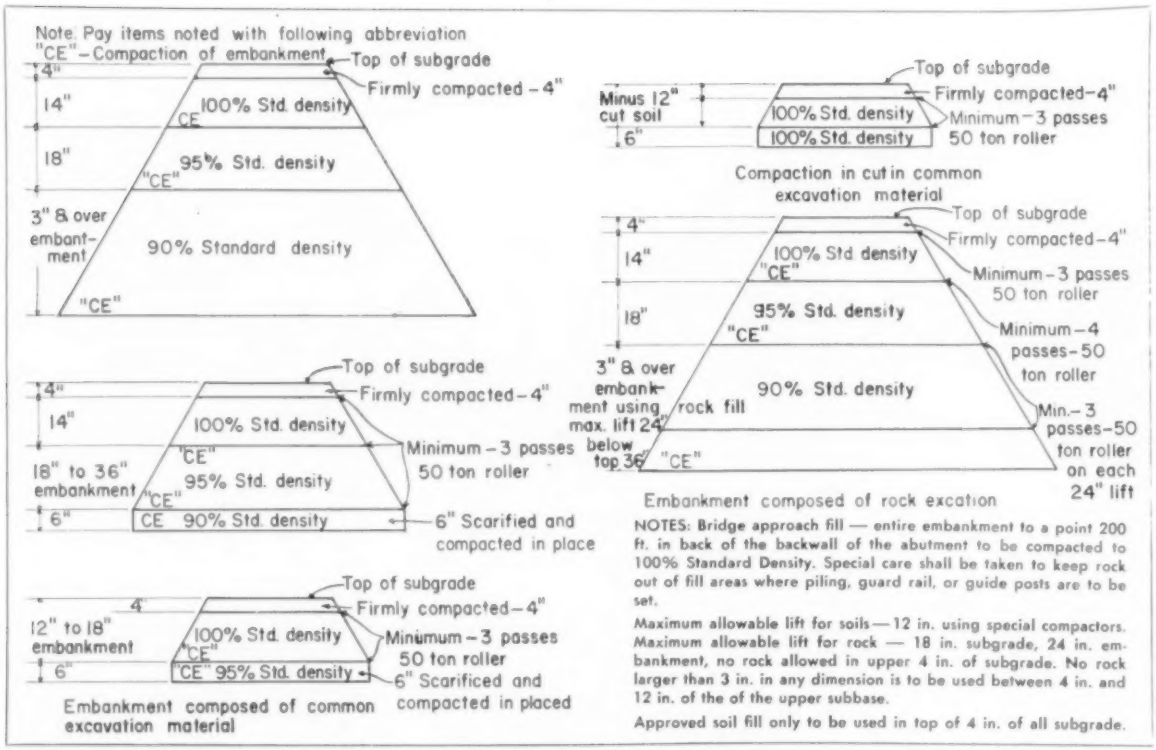
● The 236-mile Kansas turnpike traverses terrain involving a wide variety of soils, rocks and moisture conditions.

● *Special Investigations.* One of the first special investigations which drew the engineer's attention, was the field testing of the compaction specifications. The particular aim was to focus attention on the field moisture-density relationships, and the thickness of lift which could be worked with the 50-ton pneumatic roller and large tamping rollers. Two "Test Fills" were constructed for this purpose early in the spring of 1955.

The first "Test Fill" was laid in early May on Contract No. 1-2-E(1), T. F. Marbut of Emporia, Kansas, contractor. This contract is near the south end of the turnpike and the soil of which the Test Fill was constructed is representative of many soils encountered in that general area. Some valuable information was gathered during this three-day investigation, but extended inclement weather caused it to be abandoned before all of the projected phases of the Test Fill could be carried out.

A second Test Fill was constructed two weeks later on Contract 7-31-E(1), George Bennett of Kansas City, contractor. The soil tested during this investigation was representative of many upland soils encountered in

● Rolling in progress on contract section near Emporia, held by J. D. Armstrong Co., Inc., contractor, of Ames, Iowa Rolling equipment used on this heavy clay fill for an overpass approach and other parts of project, included 1 50-ton compactor drawn by a heavy crawler tractor; 3 dual-drum sheepsfoot units, drawn respectively by a heavy crawler, a heavy rubber-tired tractor and an industrial tractor; 1 water truck; 1 motor grader. "We put everything out there, and tell the operators to keep out of the way of the scrapers," said the foreman in explaining his scheme for insuring adequate rolling in midst of high-yardage scraper placement.



● Diagrammatic illustration of the earthwork specifications for various conditions.

grading the northern half of the turnpike. At this Test Fill the weather was favorable. The expense of keeping field crews and laboratories, representing seven engineering firms, plus necessary earthmoving equipment, caused the investigation to end on completion of the major experiments deemed to provide necessary information.

● *Test Fill Procedures.* The field results were obtained by preparing a borrow pit at low moisture contents. The attempt was to get a spread of 3% between adjacent areas in moving the prepared material to the Test Fill, which was staked out on a prepared earth foundation. The material was then bladed and scarified to a uniform condition and stage compaction begun. Engineers took as many tests as possible at each stage of compaction until the effects of the compacting equipment became negligible.

Most of the lifts tested were of 6-in. depth in comparing the large tamping rollers with the 50-ton pneumatic roller. Special emphasis was placed on tests of the 50-ton pneumatic on a 12-in. compacted lift, since experience in some soils by manufacturers and contractors has indicated that such a lift is feasible.

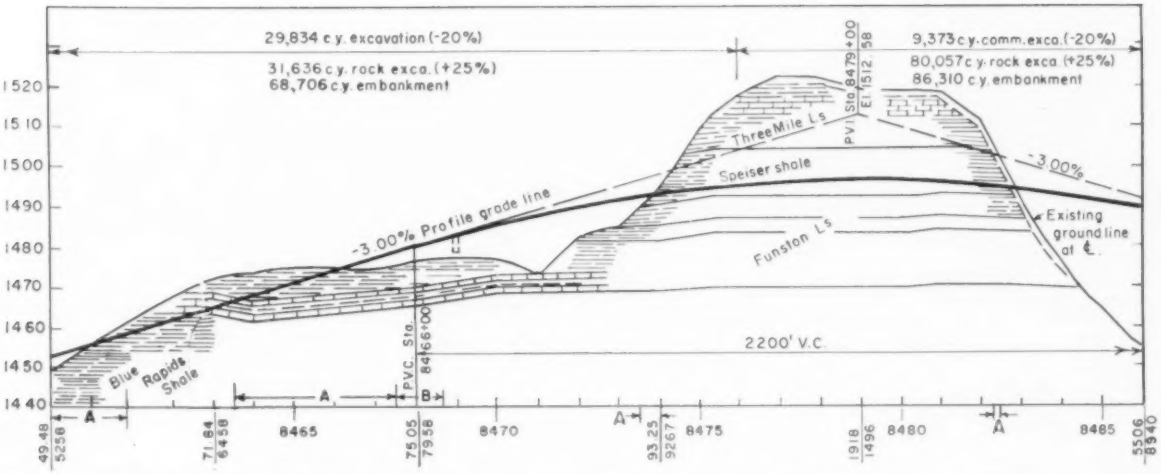
Results of these field tests were limited in providing definite answers to specific problems, as with all such field tests of limited scope.

A perusal of the information obtained did provide information of sufficient weight to assure the engineers that the specifications were well suited to the region.

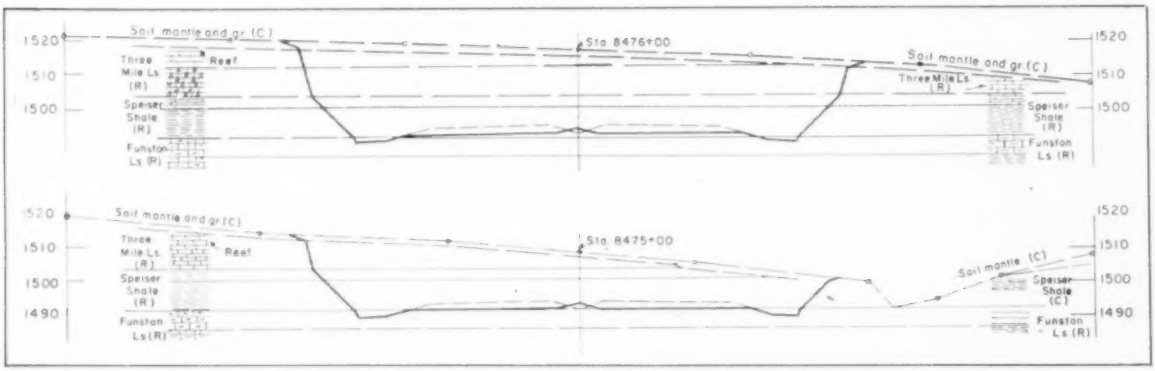
The moisture-density relationships under field compaction followed anticipated laboratory criteria in general. An interesting result was that the standard AASHO compaction curve was very near the maximum condition achieved by the heavy compaction equipment being used.

The use of lifts in excess of the 6-in. compacted thickness allowed by the specifications was intensely studied with regard to the Test Fill results. The results of many tests taken both in the top and the bottom of the trial 12-in. lifts were extremely erratic, and could not be considered sufficient evidence to allow the use of these heavy lifts without an additional requirement specifying the minimum number of passes.

● Another rolling combination used by C. F. Lytle Construction Co. on the Kansas Turnpike — An Allis-Chalmers HD-21 tractor pulling a 50-tonner.



● Typical geological profile, giving data found to be extremely valuable to contractors as well as designers. One reason given for the low earthwork bids obtained.



● Cross-sections likewise were furnished the contractors showing location of rock, shale and other soils formations.

● *Special Situations.* Other than the Test Fills, which were constructed for the purpose of developing general information as to the over-all workability of the specifications, numerous special situations have been investigated in the field in cooperation with the contractor who experienced difficulty in his operation.

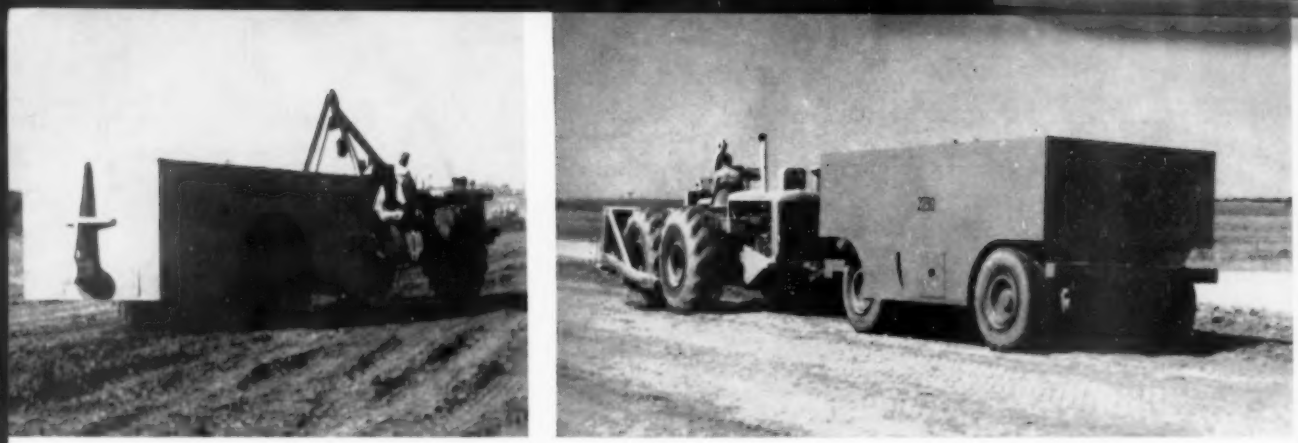
During the summer of 1955, the hot dry winds on the southern part of the project caused moisture in some soils to be reduced to 2 to 5 percent in-place content, whereas 16 percent was necessary to meet minimum requirements. The problem resolved itself into the necessity for the contractor to rip the shallow borrow areas about 2 ft. deep and pond water for about two days before excavating. And additional water had to be manipulated into the soil on the fill to achieve acceptable moisture contents. Heavy roto-pulverizing machinery was tried as a possible solution for this problem, but the capacity of the pumps which could be used with it was too low to be satisfactory. Also difficulties were found in gaining traction behind heavy watering by water trucks. The manufacturer of the equipment showed considerable interest in the problem and promised to put some thought into developing equipment which could conquer this type of situation economically.

As usual on construction where the soils are borrowed or cut from shallow areas, difficulties were experienced on many grading jobs in obtaining uniform moisture. While blades and discs proved satisfactory, the engineers became well acquainted with the McCoy scarifier attached to the back of D8 Caterpillar tractors. This piece of equipment exhibited a wide range of uses and was welcomed by the engineers wherever it was provided by the contractor.

It is capable of breaking down clods, mixing the lift to a uniform material and surface, and scarifying the top of the lift below, all in one smooth and economical operation.

● *Moisture Problem.* Water for compaction which was bid at $2.00 per m. gal. became a critical water problem during the summer months. In the first place, Kansas has been experiencing drought conditions since the big floods of 1951. Thus, except in the vicinity of a few flowing streams, long hauls sometimes nearly prohibitive in length were required to get the water to grade. The hot winds caused extremely high losses of moisture from evaporation. These two facts in the face of the specification requirements caused the contractors to search for some factor which could reduce the problem to a reasonable solution.

One solution proposed and used to a considerable extent was the addition of a commercial liquid detergent, SC-100, which by acting as a wetting agent reduced to a large degree the losses by evaporation. It also aided materially in reducing the compactive effort and manipulation required. This solution has not been accorded an unlimited use license at this time, due



● Some of the array of heavy compactors used by the contractors along the Kansas Turnpike during the 1955 season. (Left): Amis-San Ore contractor combine on Section 20-21 used this Ferguson unit, towed by a Super C Tournapull tractor. (Right): C. F. Lytle Company's rubber-tired Le Tourneau-Westinghouse Tournatractor, towing a 50-ton BMCo roller on Section 9 job.

to the lack of evidence showing its effect upon the strength of the soils involved. Tests to provide the needed evidence are now being run. If they show no detrimental effect of the soil strength, the detergent is expected to find wide use during the 1956 summer for the preparation of subgrade immediately prior to paving.

● *Re-examined Specs.* Laboratory tests have been run constantly to accumulate information with which to criticize constructively the specifications and pavement design. This was in order to give any possible tolerance to the contractor which will allow him to operate more smoothly or economically without causing detrimental effects to the turnpike facility.

The results of these tests led to the decision to permit the contractor to rework only the top inch or so of subgrade which has retained 100% compaction while between optimum plus 2% and minus 4% moisture, where construction traffic has not caused detrimental differential compaction. In lieu of this additional tolerance, the contracts require recompaction of the top 6 in. of subgrade to 100% of standard compaction at between plus 2% and minus 2% of optimum.

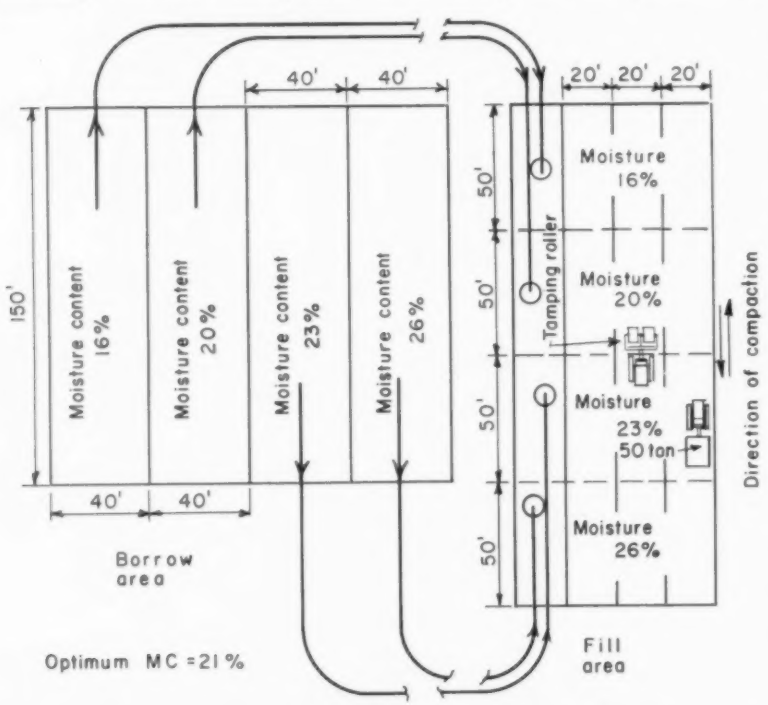
Through the winter of 1955-1956, earthmoving in the Kansas City area was scarcely affected by the weather or freezing, since the granular soils were found to be capable of gaining suitable compaction and strength even when laid at moisture contents between 4% and 6% less than optimum. This tolerance did not permit results as desirable as those called for by the specifications, but did meet minimum standards in a tightly scheduled part of an extremely accelerated project.

● *Geological Studies.* The project has benefited greatly from a detailed geology, provided by the State Highway Commission through its Geology Department. The information from this study made possible realistic estimates of rock quantities and specific details as to rock types. Through these data also the most economical and stable backslopes were designed. Thus, final excavation quantities were more readily anticipated. Explosives manufacturers representatives were able to use the information on the profiles and cross-sections, in conjunction with the written station-by-station reports noting typical local outcrops, to make powder estimates available to bidders.

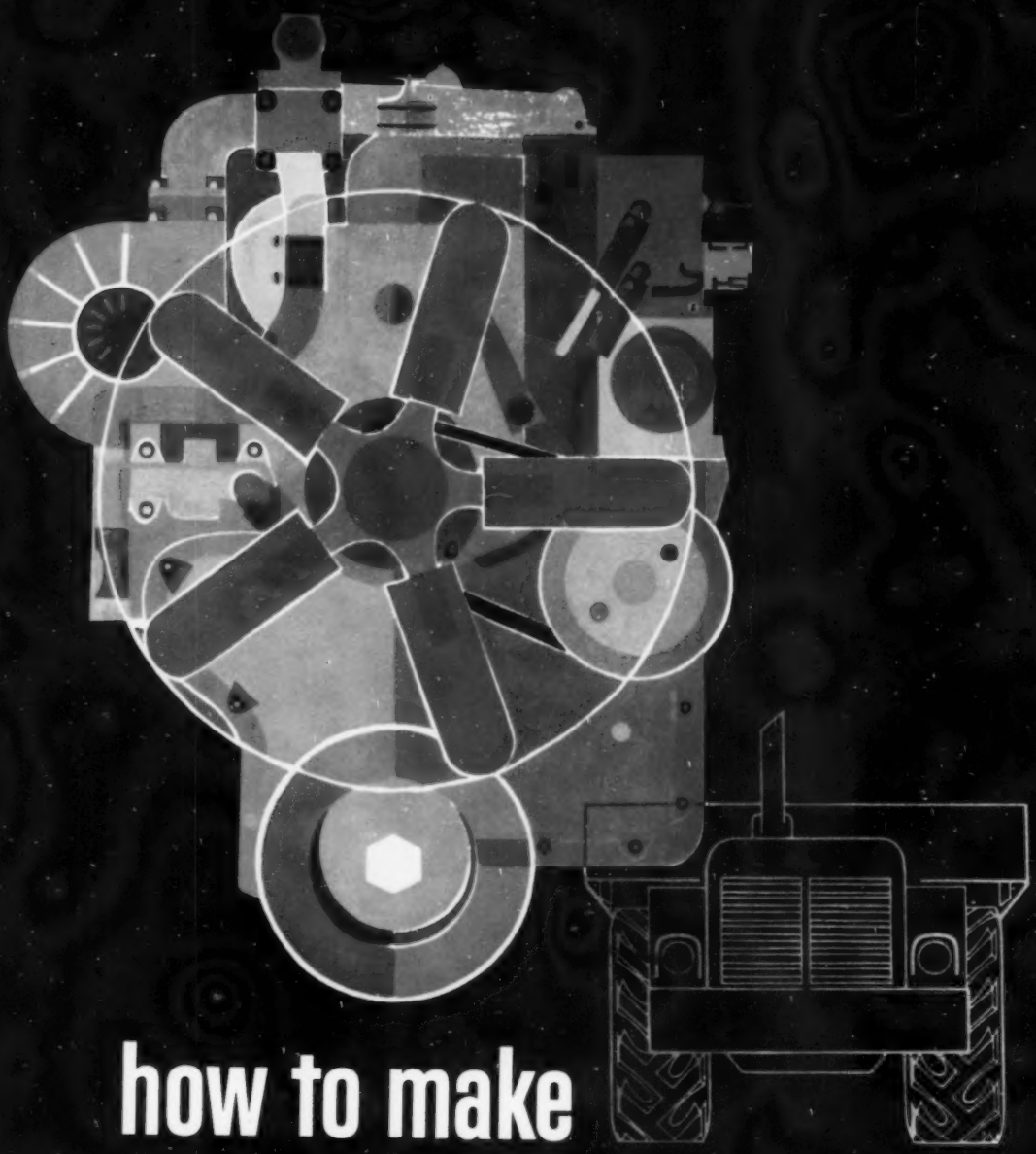
The geologists also provided specific descriptions of locations where underdrains were to be considered. This information was of exceedingly high value in estimating the locations and quantities of pipe required prior to bidding.

Through the beneficial knowledge of the types and quantities of rock to be encountered, contractors were able to be more competitive and to better estimate their rates of production and equipment requirements. This had an obvious effect which was reflected in the project-wide average prices of about $.65 per cu. yd. for rock and $.25 for common excavation.

Cooperation between engineers and contractors has been a factor in the success in the field and laboratory testing program.



● Diagram of excavation procedure in hauling earth of various designated moisture content from watered borrow pit to test fill zones.



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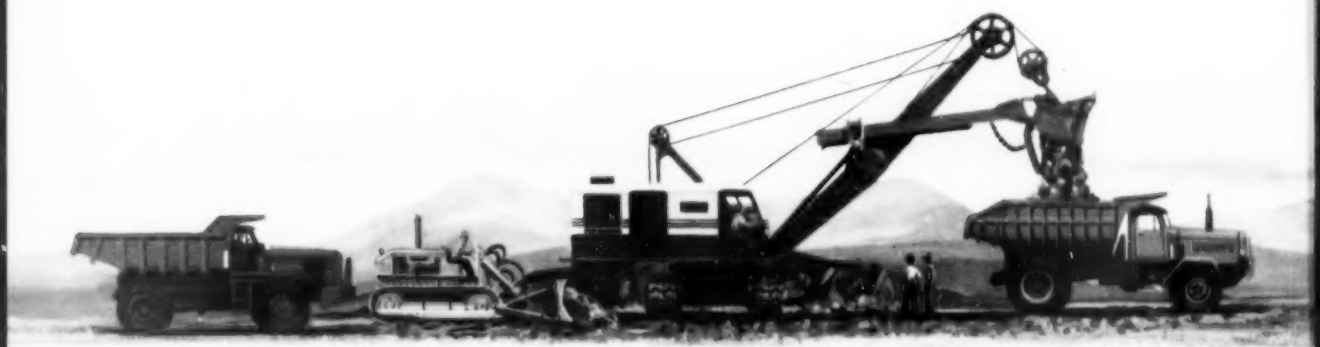

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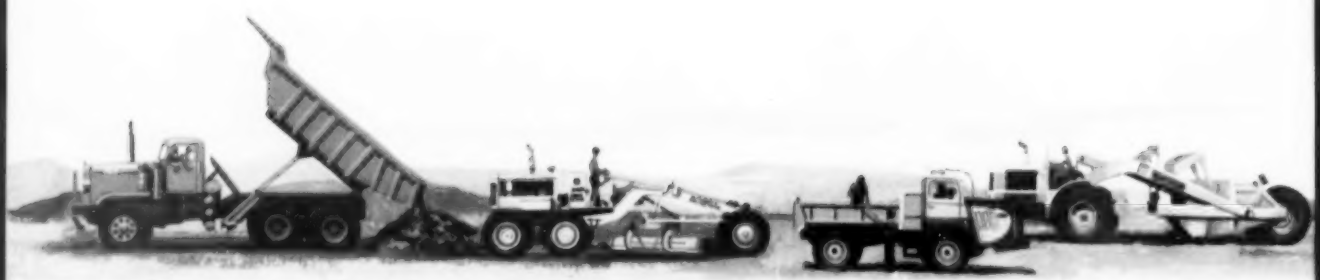
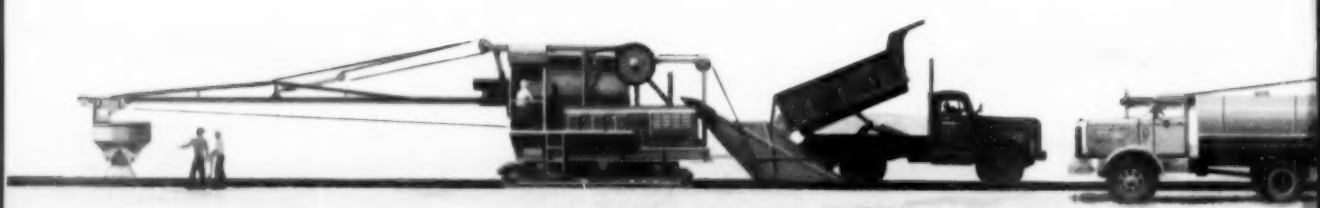


MACK off-highway ADAMS WALTER WOOLDRIDGE



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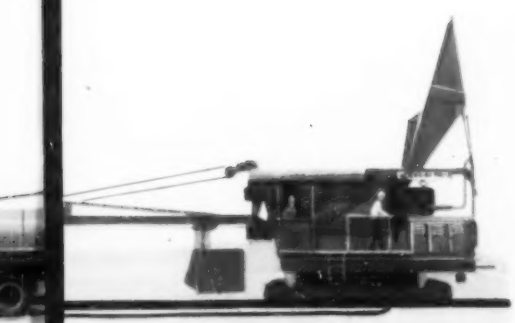

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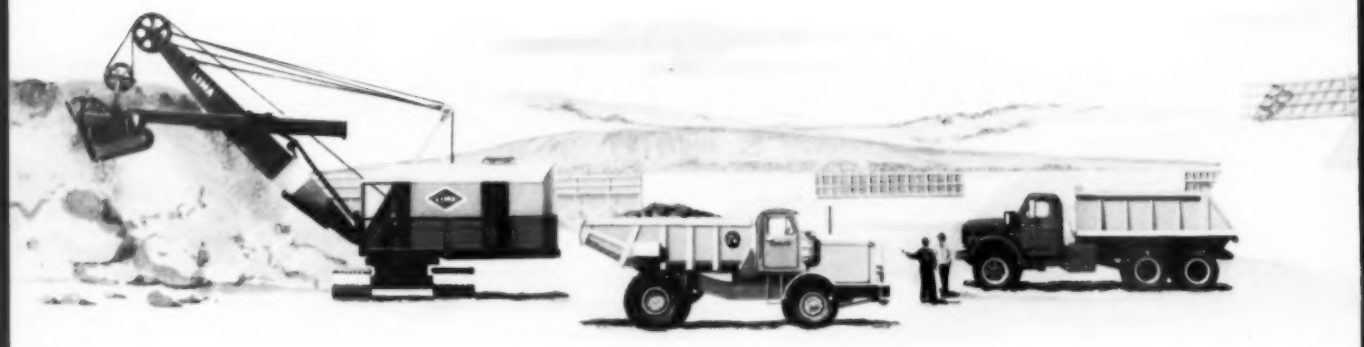

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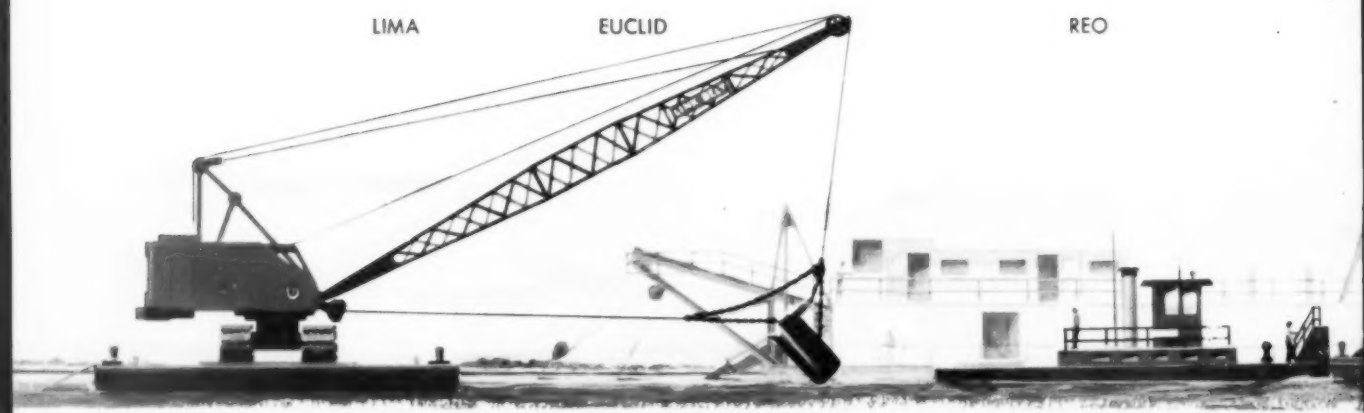

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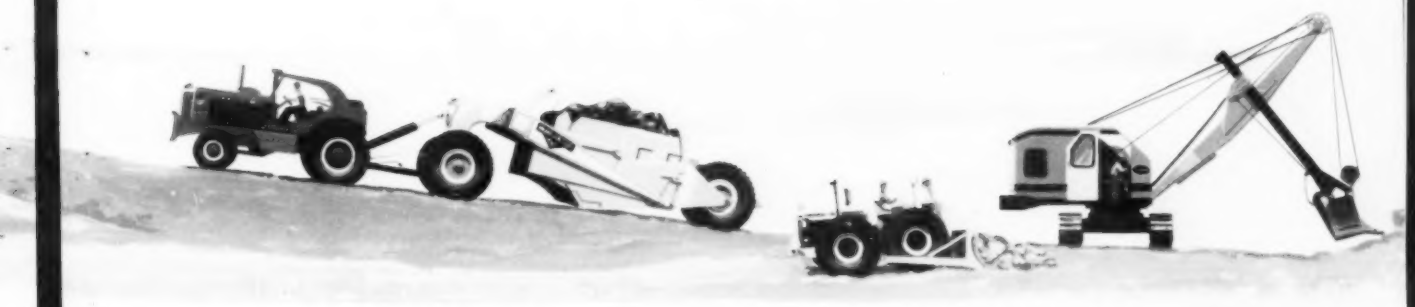

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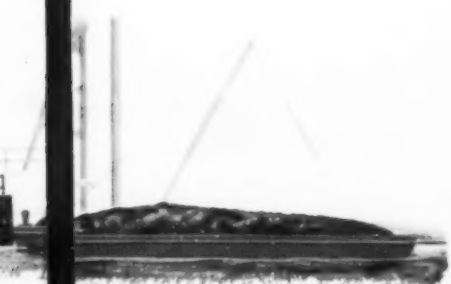

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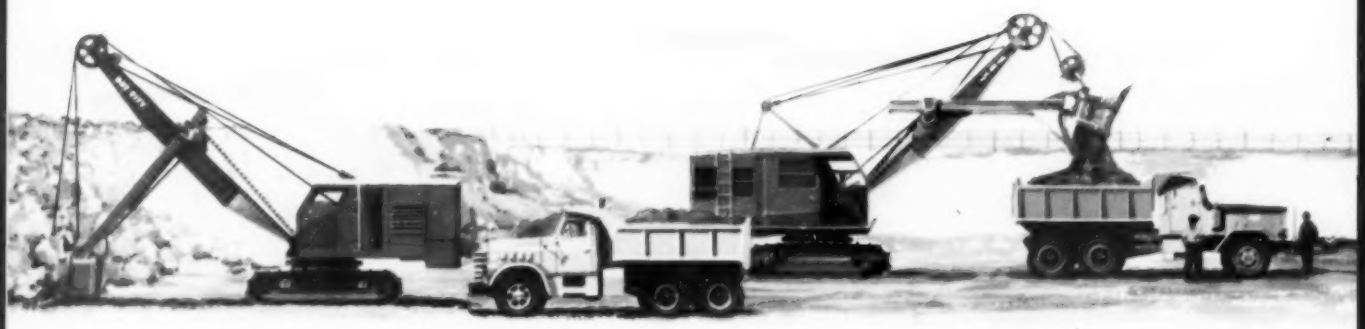

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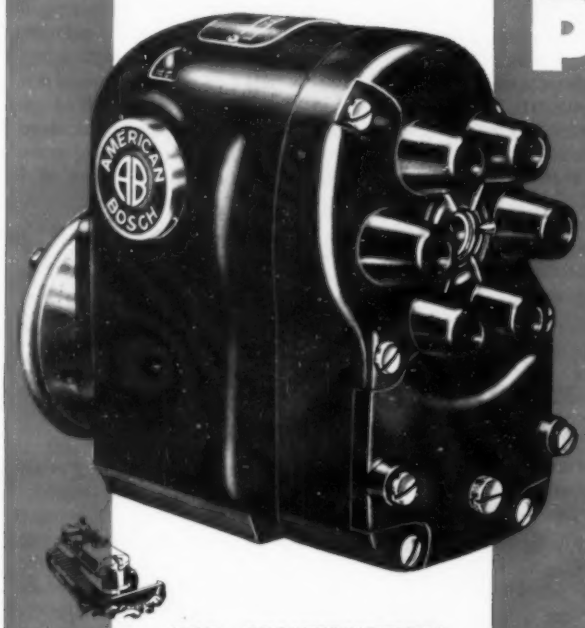

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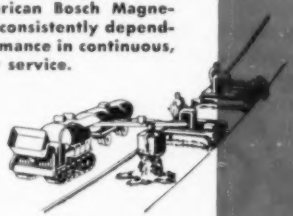

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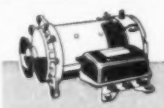

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. . . for more details circle 181, page 16

Michigan Revising Concrete Paving Specs

Concrete Conference at East Lansing spotlighted latest developments in concrete road design and construction.

MICHIGAN'S new concrete paving specifications, on which contractors have actively collaborated, was one of the topics at the Seventh Annual Concrete Conference, held April 23-24 at Michigan State University, East Lansing. Over 200 state, county, city and federal highway engineers and contractors attended the conference which was sponsored by the Michigan State Highway Department and the Portland Cement Association, under auspices of the university's Department of Civil Engineering.

Progress on specifications was outlined by Harold J. Rathfoot, the Michigan Department's construction engineer. Revised specifications for 1957 work were near the final approval stage, as a result of effort by department engineers, the Michigan Road Builder's Association and the Bureau of Public Roads. A contractor committee headed by L. M. Denton, Denton Construction Company, Detroit, has reviewed the proposed changes and offered further revisions and suggestions.

Here are some of the highlights of Rathfoot's paper:

1. Results-type specifications have been sought wherever feasible. The changes are evolutionary rather than radical.

2. The department is watching certain new equipment which seems promising. One is a new finishing machine having a wide fixed plate and transverse screeds instead of the longitudinal float. The day is anticipated when spreading and finishing can be done with a single piece of equipment.

3. Better density control of subgrade and subbase is the probable chief avenue of further improvement in concrete pavement construction. On some projects the state will require placement of a layer of processed aggregates over the sand subbase to insure satisfactory stability.

The new specifications will reflect concern over the disrupting effect of pavers and other equipment traveling between the forms. Where the contractor elects to run his paver between the forms, any rutting caused by paver and batch trucks must be ironed out and rolled before placing concrete.

4. Minor changes will effect weighing control at the batch plant. On manually operated weighing devices for aggregates, the colored lights required are to be 40-watt, so as to help the operator observe the weighing accuracy. The present specification, requiring contractors to convert to automatic batchers by 1960, appears to be unnecessary, according to Rathfoot, since Michigan contractors will have long since purchased such equipment.

5. Air entrainment control has been a subject of major concern. While air entrained cement will be required, and use of an additive is permitted (only by authorization), the contractor will be required to keep a day's supply of such agent on hand, for use in case the air content is found falling below the 4-7 percent limits.

6. An extra half sack of cement per cubic yard must now be added to the standard 5¼ sack mix when the contractor elects to use a single course aggregate size (6A stone, 1½ in. max.), rather than the permissible 4A (2 in.) and 10A (1 in.) stone combination. It was pointed out that this requirement is in line with good concrete making principles, in that concrete strength is generally governed by mortar strength.

7. Central or transit mix concrete will be permitted in irregular pours where hand finishing is permitted, and only where such concrete is set up in the proposal. The new wording allows transit mixers to be loaded to "guaranteed" instead of "rated" drum capacity, and mixed to 70 to 100 revolutions instead of 50 to 100.

8. A revision is made in contract payment reductions for undercutting cement content. A 3 percent cut in payment is made where the pavement tests from 2 to 3 percent under the specified factor. If undercut more than 3 percent, the department may elect to accept the pavement and dock the contractor 10 percent, or require replacement. Responsibility is thrown on the contractor for checking and correcting faulty weighing and measuring devices.

9. The steel reinforcement must be fastened to the load transfer basket in two places, to insure more adequate anchorage.

10. Temporary removal of paper curing blankets, when used, may be required by the engineer in order to check the finish in advance of final straight edging.

11. Curing methods will be confined to white pigmented membrane or waterproofing paper, although Rathfoot stated that some of the department engineers still believe that wetted earth or straw is necessary for adequate curing. Contractors are warned that curing membrane must be applied evenly and compound used full strength.

12. The Michigan sliding scale of payment reductions as penalty for skimping slab thickness is being continued. While considered stringent, the payment basis was agreed on by contractors and engineers, noted Rathfoot, who said that department inspectors would cooperate to help contractors keep close watch on thickness as work progressed, so as to avoid costly over-thickness as well as penalties for under-thickness.

C. J. Carroll, Executive Secretary of the Michigan Road Builders Association, who presided at this conference session, led a spirited discussion. Serveral contractors told of the high cost of providing an extra set of bins required where different aggregates are specified for structural and paving concrete. Extra plant investment of $50,000 and five additional men are called for, along with an added cost of $150 per day for another crane where two aggregate requirements must be met instead of one. One contractor challenged the department engineers to consider the "millions of dollars that will be wasted" by failure to use a single concrete mix for both structures and paving.

● *Pavement Joints.* Mr. Rathfoot's review of specifications was followed by a talk on new developments in pavement jointing by C. B. Laird, assist-

ant construction engineer, Michigan State Highway Department. This speaker traced the state's evolution in joint design, which has required load transfer dowels since 1940. Failures of doweled joints have occurred due to poor dowel alignment, locking of the joint due to improper coating of dowels, infiltration of water and resulting corrosion of bars, careless placement of the dowel assembly, and infiltration of soil from below (involved with wartime base plate design using substitute materials).

In 1952 the department approved a modified Bethlehem dowel assembly having a wider basket base and O-gauge wire basket, shop assembled, which has proven superior to previous designs. Three other commercial designs have also been approved, and a fourth is undergoing test.

Sealing of Joints

Sealing of joints is perhaps the most serious unsolved problem with Michigan's concrete pavements, said Laird. The ordinary rubber asphalt seal has been an almost complete failure in durability studies. He observed the common belief that no joint troubles will develop if construction practice is carefully followed. But he said that this answer is not an answer today. The changes that have occurred in rubber compounds furnished by commercial suppliers is partly to blame, said Laird. Michigan research engineers and suppliers met this past winter on the matter, and research has been initiated for 1956 to compare service performance of five different materials. These include the latest specification hot poured rubber, a hot poured compound upgraded for the test by manufacturers, cold applied compounds, jet fuel resistant compounds, and (for control purposes) federal SS165 specification material.

● *Michigan Durability Studies.* Latest findings from the Michigan durability test road, built in 1940 on an 18-mile state road section, were reviewed by E. A. Finney, department research engineer. This test has revealed many points of fundamental interest, he said, but none so important or so conclusively proven as the value of air entrainment as a means of eliminating scaling.

The road was built in sections designed to isolate for comparative study under normal traffic such variables as joint spacing, reinforcing, edge thickness, and amount and type of air entraining agent used, as well as finishing and curing methods.

In Finney's paper and a related discussion by Hubert Woods, assistant director of research, Portland Cement Association, two important aspects of air entrainment were pointed out. One is that air entrainment is no cure-all for concrete quality that will eliminate the need for using sound aggregates and good concrete practice generally. Unsound aggregates are a continuing problem. A few limestones and cherts in Michigan for example contain unsound particles that may result in pop-outs and other defects.

The other point is that where adequate air entrainment is secured, scaling due to de-icing chemicals is eliminated. Scepticism and rumors of the inadequacy of air entrainment often heard are due, said Woods, to the probable failure in the field to obtain the specified air content for one reason or another. Fourteen-year outdoor tests by the PCA laboratory confirm the overwhelming findings of the Michigan test road in this respect. He said that many paving jobs have been built without the proper inspection and field testing necessary to insure a constant maintenance of the specified air content. Cases were cited where the construction records showed 3 to 4 percent of air, but core samples tested 2 percent or less.

The comparative effect of salt and calcium chloride as a cause of pavement scaling was discussed by Woods. He said that much depends on the concentration of the chemical in its effect on a non air entrained concrete. But the concentration is difficult to control by winter maintenance workers; and, anyway, the differences disappear and have no significance when the concrete is properly air entrained, since neither chemical has shown any appreciable scaling effect over the long periods observed and tested.

Problems of surface finish during hot, dry winds were also mentioned by Woods. He noted that, here again, differences in durability of surface, correlated with this condition, become of no concern when the air content is under good control. He did recommend, as a means of avoiding fine shrinkage cracks sometimes occurring in hot weather, that a light fog spray of water be applied immediately after passage of finishing equipment, and that the curing cover be applied promptly.

● *Subbase Construction.* The subbase, or layer of granular materials placed between the subgrade and the pavement, was discussed by Earl J. Felt, manager, transportation development section, Portland Cement Association. This paper, too detailed to be covered here, brought out that some subgrade blankets do not contribute to the economic design of the total pavement system. One reason is the inadequate compaction of this layer, resulting in a pavement support having little or no better ability to obviate pumping than the raw subgrade material.

The engineer will specify a high "K" value of the subgrade, he noted, then fail to take advantage of the support thus provided, by not seeing that the subbase is properly densified. In a recent investigation, samplings of the subbase test 95 percent average density, but a more detailed check

(Continued on page 147)

Jute Roll Required for Freshly Sawed Joints

Sawed construction joints, made standard for Michigan work in 1955, have definitely improved riding quality, said C. B. Laird of the state highway department.

The new specifications will require caulking of transverse contraction joints with a jute roll immediately after sawing, done to prevent contamination prior to and during the sealing. The state is actively testing the formation of dummy joints with Styrofoam corrugated paper, used as a substitute for a steel forming mandrel. This joint is said to offer economies over sawing the concrete, but sawing out the paper has presented problems.

The state experimented with sawing of ½x2 in. transverse joints, with saw companies cooperating. Double-disc diamond blades ⅜ or ¼ in. thickness were used with ⅜ in. space between blades. No raveling problem was encountered. The high cost (about 50 cents per foot) has not been solved. But beyond that, is the design problem of providing a wider joint than the customary ¼ in. sawcut for the Michigan standard dummy joint specified at 99 ft. intervals. Greater joint thickness is required to accommodate expansion and creep of slabs of this length.

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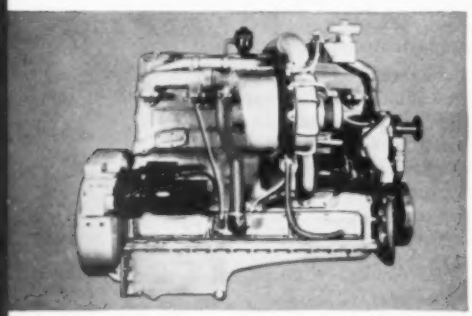
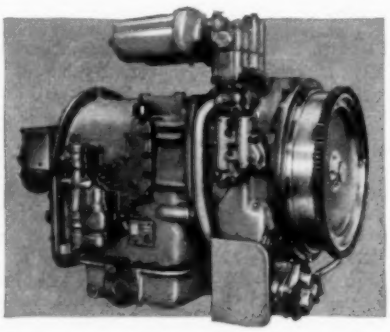
These features are the result of rigorous, field testing. Payhaulers have worked on many contracting, mine, quarry, and similar jobs. Others have run "round-the-clock" at our proving grounds. Others have undergone painstaking laboratory research. Now all this testing is completed and the Payhaulers are ready to roll. You owe it to yourself to check their features. Our test users did—and, as proof of outstanding Payhauler performance, a great many have placed their orders. Compare Payhaulers with your present hauling units to see what profit-making features you will get.

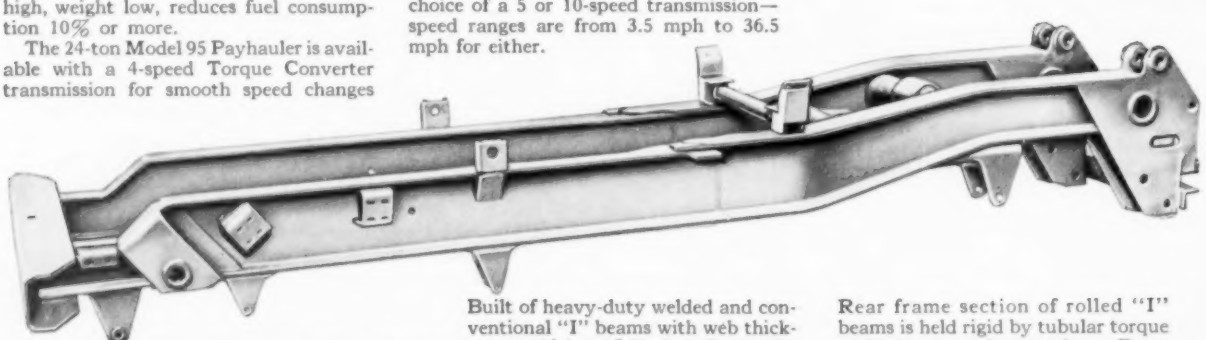




TURBO-CHARGED DIESEL ENGINES—CHOICE OF TRANSMISSIONS—Both the "65" and "95" Payhaulers have more horsepower per truck yard than any other truck in their size classes. The 24-ton, 16-yard "95" is powered by a 335 hp diesel...the 18-ton, 12-yard "65" is powered by 250 hp. Turbo-charging keeps power high, weight low, reduces fuel consumption 10% or more.

The 24-ton Model 95 Payhauler is available with a 4-speed Torque Converter transmission for smooth speed changes from 4.8 to 38 mph. A lock-up clutch for direct drive performance and a Torqmatic brake system are standard with the Torqmatic transmission. Also available for the "95" Payhauler is a 9-speed transmission which provides an excellent range of speeds from 2.6 to 37.2.

In the Model 65 Payhauler you have a choice of a 5 or 10-speed transmission—speed ranges are from 3.5 mph to 36.5 mph for either.



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- Rugged All-Welded Steel Frame
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- Speeds to 38 MPH
- Power Shift Transmission

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. . . for more details circle 241, page 16

● New streamlined locations, often involving heavy grading quantities, will be required for a large proportion of the 40,000-mile Interstate System reconstruction job. This is California's new San Bernardino Freeway, being built by a state which since the war has invested most of its highway construction funds in controlled-access, multi-lane freeways on new location.

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The Federal Role in Highways
How Detroit is Set to Go

Blueprint

for an Expanded Highway Program

How the highway industry must mobilize to meet the new problems and opportunities created by the proposed $51.8 billion 13-year federal highway program.

THERE was little debate over the size of an expanded roadbuilding push, when the House of Representatives approved the Fallon bill. This measure would launch the nation on an unprecedented era of road building, fed by $37 billion in federal funds during the next 13 years.

As this is written, the Senate has not yet decided how it will influence the bill, but all indications are that the American people will be given this session the legislative approval for a major renovation of the highway system.

The immensity of the planning and engineering job ahead for state and city engineers, the complexity of the mass land-acquisition chore that must get under way shortly, the doubling of the construction market for highway contractors — all of these prospects loom on the horizon. The program envisioned by Congress will be the grandest internal improvement project in the history of any country — the largest expenditure of public funds for anything short of defense.

No one can predict the final course of the long-range effort contemplated, but one can grasp the immediate future. The problems involved are coming sharply into focus as the bold new federal-aid program is being readied for superimposing on top of a roadbuilding volume already at a record-breaking level.

These prospects — and these problems — have been foreseen by the most farsighted leaders in the highway industry. We have attempted to reflect their foresight within this special "round-up" story.

It is a part of the picture that the job will be started and for some years operated under adverse conditions. Now that the package is about to be sold, the customer will want "immediate delivery." The industry will be hindered in its desire to deliver by some very real handicaps — but none that are unsurmountable.

• There is no excuse, for instance, we believe, for an engineering shortage of the severity we are now experiencing, or for it to continue in anywhere near the degree that now exists.

• The cities are far behind in their inventories of motor transportation assets and needs, and will have to work fast if they are to be able to take full advantage of the federal assistance for which they have been pleading so long.

• Many of the states have lagged in obtaining the legislation needed for orderly programming, acquisition of right-of-way, and access-control. Some have not yet begun to utilize improved methods, already at their disposal, which would speed the completion of plans.

Although we start the job with these burdens, we also begin it with distinct advantages:

• We have in this country a group of alert, aggressive contractors, skilled in estimating the cost of construction, who are willing to take the risk involved that their estimates are correct, and understandably determined

A Roads and Streets Staff Report

● The spotlight is on the Interstate System — the 40,000-mile network which will tie the nation together and which will eventually attract 20 to 35 per cent of all rural motor traffic.

Blueprint—

to prove their skill and capacity on bigger project volumes. The road builders have proved their capacity to expand quickly, to think creatively, to invent, to devise, to develop methods that complete the work faster and better.

• We have in our state highway department and the Bureau of Public Roads, a force of highway administrators who have the confidence of the public, years of experience in squeezing the most out of the highway dollar, and who have engineering know-how and administrative ability.

• We have at our disposal a huge equipment fleet and assembly lines to produce more machines in ample supply. The mammoth construction job envisioned would not be possible without the large, fast-moving machines with which we build highways today. There have been remarkable developments in equipment since World War II. The next decade will undoubtedly see the testing of equipment that will further streamline construction methods.

• Our natural resources are in bountiful supply for the building of these facilities. It is true that we are experiencing shortages in some materials which will continue for at least the first year of the program. But suppliers have assured the industry that they are willing to expand their productive capacity and that, within a few short months, the problem will be eliminated.

• We have the enthusiastic support

Editorial Note: As this issue went to press, Senate committee action had altered some features of the $51.8 billion Fallon bill, as passed over-whelmingly by the House. The prospects however continued to look good that we will soon have some kind of a big new road program. This report, prepared by Duane L. Cronk and the ROADS AND STREETS staff, shows the job we have to do if given the funds and allocations, as set up by these measures or in one that is comparable.

The law as finally signed by the President may include further important modifications. Should this be so — or should Congress again fumble and put off this legislation — the appraisal published on these pages is still a blueprint of the task that inevitably lies ahead. It is a job of such magnitude that the highway and municipal departments cannot get ready too soon.

Reprints of this review in the form of a 20-page folder are available in limited quantities, for use by individuals or organizations who might wish to bring the need for action to the attention of state legislators, editors or others of influence. Single copies free for the asking while the supply lasts. Quantity quotation on request. Address Editor, ROADS AND STREETS, 22 West Maple Street, Chicago 10, Illinois.

of a citizenry which is now fully aware of the essentialness of "good roads," and the backing of an industrial community which finds itself increasingly dependent upon highway transportation.

These are our liabilities and our assets at the launching of an expanded National Highway Program.

As we eliminate from the one and add to the other, the American people — who have said they are willing to pay the bill — will receive the facilities so sorely needed to restore "auto-mobility" to the American transportation scene.

Spotlight is on the States

THE National Highway Program when finally enacted by Congress will land squarely in the laps of the state highway departments. Under the traditional relationship between state and federal government, the latter may furnish most of the money, but the states must build the roads. There will be no *one* "Blueprint," but 48 different patterns in as many states, each determined by the needs in that state and its readiness to go ahead.

In a talk titled "Follow-Through in the States," Albert Bradley, chairman of the Board of General Motors and chairman of the National Highway Users Conference, told a Washington, D. C. audience last month:

"The states, and counties and cities, will continue to be the real key to progress. Viewed in proper perspective, the federal program is designed to meet an emergency situation . . . it is an urgently needed transfusion, but not a permanent cure.

"The states, too, must provide funds. They must plan and build the new roads, working with the Bureau of Public Roads in its coordinating role. They must maintain and police them. And they must see to the adequacy of the extensive mileage of essential highways not embraced in the Federal-aid system. Counties, cities and special authorities also have broad responsibilities beyond those for which Federal-aid is provided.

"Even with the contemplated big increase in Federal funds, about two-thirds of the money needed must still come from state and local sources."

The Administrative Job

Problems that have stood in the shadow of the great Congressional debate are now moving forward to confront the state highway department administrators whose responsibility the vast construction program becomes.

The potential obstacles to full production now coming into focus are not minor ones. Some are so knotty they will confound highway departments for years. It is safe to predict that some states will be seriously frustrated in their attempts to put the new funds to work for months. The *engineering* chore will be difficult, but not baffling. It is the *administrative* dilemmas now shaping up that will demand imagination and resourcefulness.

Some will probably never be solved, and the expedients adopted to meet the situation will undoubtedly alter the practice of highway design and construction significantly. There is a familiar saying, "Necessity is the mother of invention." Highway officials will become intimately acquainted with Mother Necessity during the first months of the National Highway Program and invention will become the order of the day.

The question to ask is: "How ready are the states to face up to The National Highway Program?" For examples:

- How many have made comprehensive needs studies, so they know where the federal-aid will do the most good?
- How many have project priority programs so they know what projects will be tackled first?
- How many are prepared with adequate legal tools needed to acquire — immediately and in large volume — the right-of-way for the new highways, or to control access where necessary?
- How many have a shelf of construction plans, ready to award jobs as soon as the money becomes available?
- How many are trying to beat their engineering shortage with really aggressive and intelligent recruiting programs?

The answers to these questions will determine the blueprint for the new road program in each state.

Comprehensive Needs Studies

All but a few of the states have made highway studies. According to Stedman T. Hitchcock, a Bureau of Public Roads planning engineer, "Most of the states have a pretty good planning foundation." The Automotive Safety Foundation has helped about 18 states make objective inventories that have spurred state legislature to action. But not all are up-to-date.

"A study made in 1947, '48, or even '49 may be outmoded today," J. P. Buckley, ASF's highway engineer, believes. "We have moved fast in some states before their programs can be brought to the construction stage. The challenge will be to move things along in balance over a wide front.

The lack of legal tools for speedy acquisition of right-of-way and for control of access will hamper some departments. The lack of construction plans in others, for the first year or so of the program, will cause some criticism. And the engineering shortage is widespread and acute.

These are some of the moves that need to be made before the program will roll into high. As Alf. E. Johnson, executive secretary of the American Association of State Highway Officials said last week:

"There are no two ways about it. We have got to produce, and produce fast."

Long-Range Priority Programs Needed

Comprehensive needs studies, particularly those drafted by the Automotive Safety Foundation, carry recommendations for 10-, 15-, and 20-year long-range programs. Some of the states have adopted such programs. About 31 states have drawn up programs based on sufficiency ratings detailed enough to win approval of the Bureau of Public Roads. Five other states have used their own sufficiency rating systems to give order to their long-range programs.

The remaining 11 states need to buckle down and take this all important step to guarantee that the new funds will go where most needed, highway leaders agree. Otherwise these states may not have the facts with which to resist dissipation of funds for political expediency.

Other measures must be enacted

Blueprint—

the last few years. No one foresaw how greatly traffic would increase. Costs have gone up that were supposed to go down. . . Every state should probably take another good, long look at its program right now."

The real planning bottleneck will probably be in the *cities*, where most of the groundwork is yet to be done.

Will Plans Be Available?

THE seriousness of the construction plans predicament is revealed in some statistics from the Bureau of Public Roads. There was available in federal funds and state matching money for programmed and unprogrammed projects on last March 1 nearly $2 billion. According to the federal agency, construction plans for federal-aid jobs at that time were being completed at the rate of $141 million worth per month.

So at the current rate of plans completion, it would take the 48 states some *14 months* on the average, to put the money now available under contract if they devoted all their efforts to this backlog alone.

This July 1, however, the national highway program if signed into law will unroll with a clap. Under the Fallon bill or its equal, nearly $1.2 billion more will be immediately available in federal funds and state matching money, presumably throwing the states another 9 months behind in plans completion.

But this is just a whisper of what will land in the laps of state highway administrators in another year. On July 1, 1957, under a "Fallon-sized program, $3.3 billion more will be available for work on the Interstate and the other federal-aid systems — or, at the current rate of production, another 23 months of plan preparation work.

In short, $6,447,000,000 will be available in state and federal funds by July 1, 1957, (13 months from now) and, at the current rate of plan completion, it will take 46 months to push this construction volume to the contract stage.

Some states, as might be expected, are in "fairly good shape"; others are in a desperate state of unpreparedness. In a recent meeting of BPR district engineers representing the 11 Western states, it was discovered that it would take some departments *more than five years to complete construction plans for money which will be available within the next 13 months.* And the program is expected to be stepped up steadily after that.

The accompanying table shows the average rate at which these 11 states are currently completing plans, the funds which will be available to them by July 1, 1957, and how long — unless they are able to speed up — it will take them to bring that much money to the contract stage. These states are not being singled out for criticism. Their plight is merely cited as typical of the problem that faces highway departments everywhere.

(Coming: ROADS AND STREETS in a forthcoming issue will carry a special report on how these states and others are attempting to speed up plans preparation.)

We Must Find Engineers

ONE of the most baffling obstacles ahead — partly the cause of the lack of a backlog of construction plans — is the shortage of highway engineers.

How serious is this bottleneck? A few months ago, a Highway Research Board study determined that 4,000 more engineers would be employed by state highway departments right now, if they were available, to handle the *current* work load. In addition, another 4,000 engineers will be needed by the state highway departments for each $1 billion worth of new work. Each figure, alone, represents the whole corps of graduate civil engineers who will come out of American universities and colleges this Spring.

The engineering shortage goes back a long way. Only about 7½% of our college students choose any kind of engineering curriculum. Out of this annual total of some 22,000 engineering students who graduate, only about 4,000 are civil engineers. And only about 14% of these young men are going initially into highway work.

In brief, *less than 3% of all engineering graduates are being drawn into highway work.*

Generally speaking, the state highway departments are currently able to recruit less than one-third the number of graduates they are seeking. If the problem has been that awkward in the implementing of current road programs around the country, what will be the effect of the shortage on a road building program which moneywise, at least, could double within a few months?

The dilemma is not one for the state highway departments alone to solve. It is unlikely that contractors, materials suppliers and equipment manufacturers will let a bottleneck stand in the way of full production.

Highway leaders close to this problem are recommending that two activities be aggressively pushed:

- That the highway departments boost salaries so they can compete with other industries for engineering graduates—so they can get more than 3% of the total. However, the salary scale has too long been an excuse for lack of effort. And it has been overplayed as an obstacle to recruitment. Young men are drawn by other incentives than money, as other industrial recruiters are proving daily.

- That the highway departments step up recruitment drastically — as a full-fledged activity, rather than as a secondary function of the personnel director.

Highway departments can learn much from other industries. Many manufacturers retain recruiting experts whose knowledge of the "market" is specialized and whose techniques are born of resourcefulness in a highly competitive business. It costs over $2,000 to bring in an engineer on the average, but intelligent "scheming" can pare that cost considerably.

State highway department recruitment efforts have been, in most cases, routine and uninspired.

"When it comes to recruiting, you people are pikers," an educator told state highway officials meeting in Boston recently.

To launch a highway engineering

recruitment campaign commensurate with the need would require more money than many departments would spend, much imagination, and zeal. If the highway industry lacks these, the engineering shortage will probably be "something to learn to live with" for a long time, the experts are saying.

On the Other Hand

In the meantime, and on the brighter side, some state highway departments are doing a remarkable job of utilizing their existing engineers. Such efforts have taken a number of forms, many of which ROADS AND STREETS has recently publicized. They include:

- Developing a strong corps of technicians to take much of the routine engineering work load.
- Moving engineers out of administrative positions and into jobs requiring engineering judgment.
- Sharpening up the efficiency and productivity of staff engineers through in-service training programs.
- Adopting modern engineering methods, such as use of aerial photography to replace ground surveying and electronic computers to replace manual figuring.
- "Farming out" preliminary engineering, design work, and preparation of construction plans to consultants.

The pace at which the highway program progresses will probably depend upon the effectiveness of such techniques. As one industry representative put it last week:

"The ceiling on how many highways we get built next year, and the year after, will not be a shortage of materials or money, but of men. The lack of engineers will make it impossible for a number of states to take full advantage of the money they have waited so long to receive."

● Design rooms will be bulging with the work load ahead, and filled with the strange sounds and sights of electronic computers, plotters and other new labor and time saving devices.

Shortage How Serious?

In a report last January before the Highway Research Board, Carl E. Fritts of the Automotive Safety Foundation, made these startling statements about the seriousness of the engineering shortage:

"Highway departments up to now have been able to subsist to a large degree because the first crop of engineers recruited in the road program of the 1920's are still in service. However, the age situation is becoming more critical and new blood must be injected at a faster rate. A few examples taken from recent studies serve to make the point:

- "In one state 15 of the 24 men in the top three grades were over 60 years old. In the same state, out of a total of 238 engineers in grade II, only 13 were under 40 years old. No one in grade III or higher was under 40 years old.
- "In another state over one-third of the personnel employed in engineering work are over 60 years of age and only 12 graduate engineers out of a total of 89 qualified engineers are under 45 years of age.
- "Another state has a total of 619 engineers with one-third over 50 years old. In the same state 182 employees are classified as junior engineers or instrumentmen. The average age of the 182 men is 40 and only 13 of them are college trained.
- "In another case, one-third of the entire engineering staff will be retired in 15 years and another one-fifth will follow in the next five years.
- "In one of the smaller states with only 71 engineers, 17 are now eligible for retirement and only six men are under the age of 40.

"Those individual cases do not necessarily represent a national average condition, but they do illustrate the fact that many states thus far have fallen far short of laying the groundwork which will build strong engineering forces for the future."

Political shake-ups by incoming state administrations, following election, are a chief cause of the hesitancy young engineers have of entering highway department or city street work in some states. There is little incentive to make a career in state service when it is known that, come election day, the senior staff men get swept out.

(Continued on page 100)

Traffic Jam in Design Rooms!

Number of months required for plan approval at current average monthly rates* covering all federal-aid fund balance available as of February 29, 1956, plus new allocations immediately available under the Fallon Bill for year beginning July 1, 1956, and for year beginning July 1, 1957 (including state-matching funds).

	Grand Total of Funds Available ($1,000's)	Av. Monthly Rate for Plan Approval (6 mos. Ending 2-29-56) ($1,000's)	No. of Months Required to Complete Plans for all Avail. FA & St.-Match. Funds
Arizona	$ 50,251	$ 1,289	38.9
California	408,360	8,790	46.5
Colorado	77,129	1,616	47.7
Idaho	43,428	716	60.7
Montana	80,867	1,236	65.4
Nevada	34,387	950	36.2
New Mexico	61,403	1,595	38.5
Oregon	70,920	3,181	22.3
Texas	273,927	11,338	24.2
Utah	51,091	921	55.5
Washington	119,777	1,893	63.3
Wyoming	60,465	1,058	57.1
National Total and Average	$6,446,853	$141,039	45.7

*Based on 6-months period ending February 29,1956.

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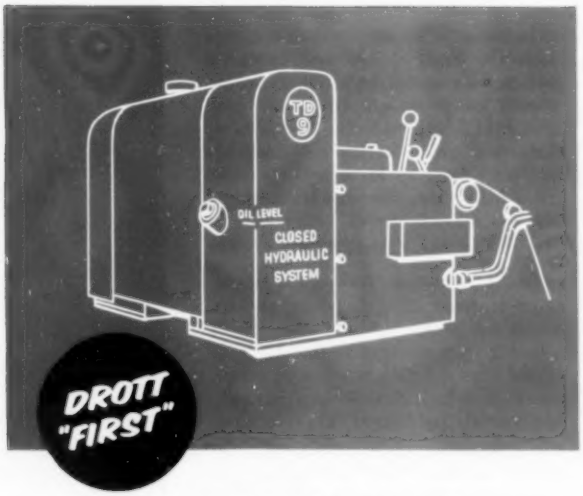
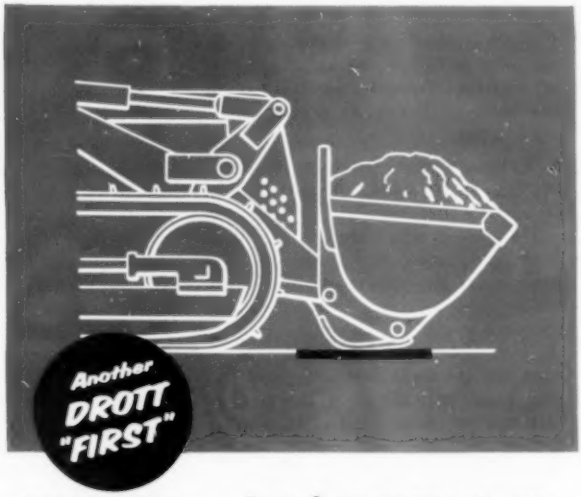
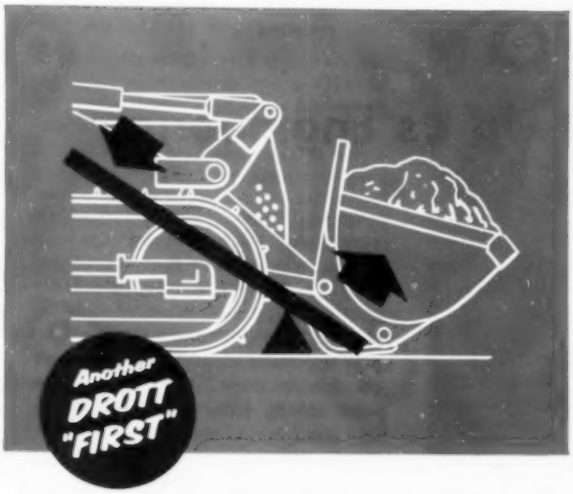


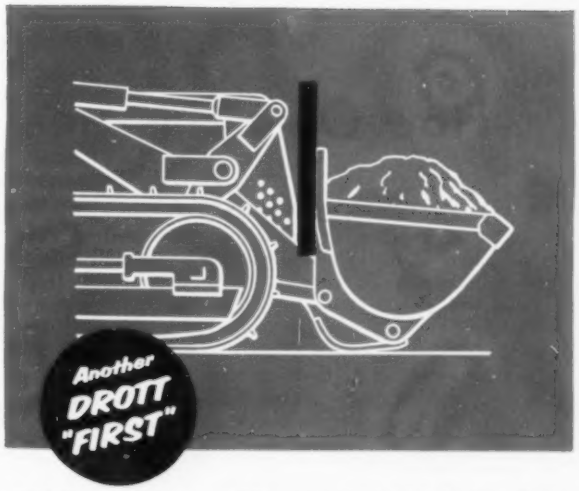
SINCE 1937... Closed hydraulic system Excludes abrasives and other foreign material—reduces wear and simplifies servicing. Keeps oil in; keeps air and dirt out.



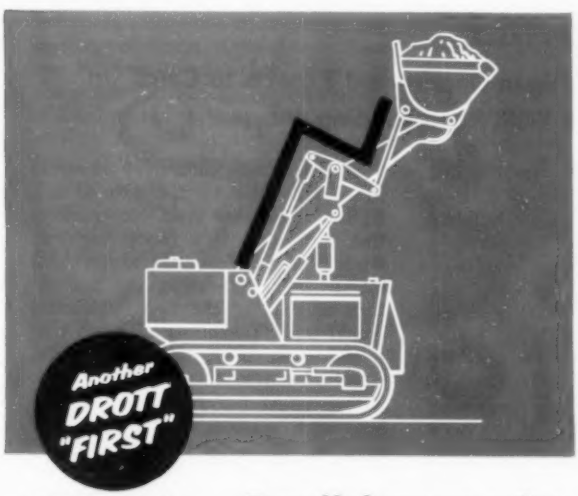
SINCE 1944 . . . Load transport on patented, exclusive, frame-mounted skid-shoes Prevents tractor "teeter-totter"; saves carry strain by "semi-skidding" heaped loads. Increases yardage.



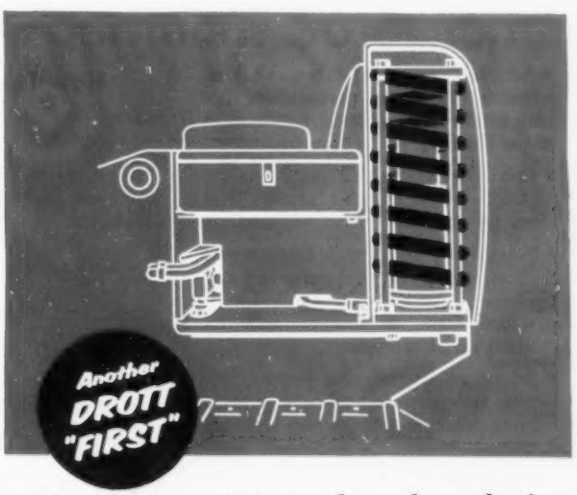
SINCE 1944 . . . Pry-action break-out Employs simple lever principle to give you *exclusive* triple-power digging force, ranging from 12,800 to 55,000 pounds! Shunts stresses into ground, so they can't maul bucket or tractor.



SINCE 1944 . . . Ground-level bucket roll-back Obtains heaped loads; *keeps the heap* to deliver extra yardage.



SINCE 1944 . . . Parallelogram raise action Keeps bucket at its 42° non-spill, roll-back level, all the way up. Increases yardage—avoids "spill-back."



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. . . for more details circle 313, page 16

Blueprint —

How Ohio Has Geared Up its Engineering

IN BUILDING up for a rapidly accelerating road construction program, Ohio is in a better position than most states to absorb the upcoming work load.

Highway officials there, as in most states, have been faced with steadily increasing work. But, their attitude has been more aggressive. They have "played all the angles" to build up their plan production team. The result is an operation in relatively good shape for further growth. Here are six of the steps Ohio has taken:

- Shifted part of the work professional engineers were doing to technicians. This required a thorough review of technical personnel and a determination of chores they could assume to lighten the work load of the engineering staff.
- Adopted an over-time working schedule on plans preparation, not only in the central office, but in most of the districts.
- Employed consulting engineers for preliminary engineering studies and often for complete plans preparation.
- Expanded the Aerial Engineering Section, with additional personnel and equipment, to get out detailed construction plans for surveys made by modern aerial methods.
- Set up an Engineering Report Section to specialize in preliminary engineering work and assist the divisions in this phase.
- Developed a design manual for the guidance of both staff and consulting engineers. By spelling out desirable design standards, methods of procedure and policy, this basic handbook is eliminating misunderstanding and confusion.

In addition, the department has adopted numerous short-cuts that have reduced the plan-preparation chore. Some of these were: Adopting station grading, adopting a standard driveway plan, eliminating design details for minor structures through use of standard drawings, standardizing *General Notes* and super-elevation and other tables, and eliminating many non-essentials.

The Ohio highway department is leaning heavily on consultants. Last year, consulting engineers completed plans on 17 major rural projects, representing 107 miles of work worth $60 million. Twelve firms were retained to provide engineering reports on 236 miles of highways, with detailed construction plans for 152 miles having a cost of $90 million.

Aerial surveying has been a specialty of the Ohio department.* It has pioneered in developing the technique since 1946. Last year, the aerial engineers flew 45,930 miles, exposing 8,291 photographs for location and design. The unit's original purpose of providing photography for highway location study has been expanded until its services now include preparation of maps, site plans and construction plans.

*"Ohio Pioneers in Better Use of Aerial Engineering," by Duane L. Cronk, ROADS AND STREETS, December, 1955.

Some 196 site plans for structures were completed by this unit last year. Uncontrolled mosaics covering an area of 1214 sq. mi. were laid. Topographic maps at a scale of 200′/1″ with 5-ft. contours were compiled for 92 lineal miles of proposed highways. Planimetric maps 50′/1″ were compiled for 27 miles of detailed highway construction plans.

Detailed construction plans for 25 miles of highways to cost an estimated $15 million were prepared by the plan preparation unit of the Aerial Engineering Section. Most of the plans developed by this unit were on locations in rough terrain where the old conventional method is laborious.

How The Michigan Department Expects to Catch Up With Road Building Job

Most states can now, for the first time, see "daylight" upstairs in their climb out of the highway building hole. Take Michigan, for example, a typical midwestern state, road-wise. As the home of the nation's big auto production, Michigan is car-conscious; its residents have been "good roads" advocates for years. But the need for new highways in Michigan outstripped the funds available beginning about three decades ago. It has been rough sledding. Now, finally, it looks as if the new Program will provide a goodly share of the necessary funds.

What would be the effect of the National Highway Program ala Fallon bill on Michigan?

The state highway department is currently administering an $83.7 million construction program. About 35% of the cost, or some $30 million, comes as federal aid. The state Motor Vehicle Highway Fund and federal-aid fund allocations provide the balance. Without passage of a National Highway Program by Congress, Michigan would probably have resorted to borrowing for the additional sorely-needed highway funds. Under present authority, some $54.5 million annually could be raised by bonds, making it possible to boost roadbuilding funds to $145 million a year for the next 10 years.

Over a decade, such an effort would make it possible for the state to sink $1.45 billion into road construction. But, according to a recent highway study, the state's needs would total $2.347 billion. In short, the best efforts to date of the state legislature would make possible a program that would meet only 62% of the total need.

Passage of the National Highway Program by Congress would have quite an effect on this picture, and is examined briefly here because it typifies the vitamin infusion that would happen everywhere. Under the Fallon provisions, Michigan would receive $1.7 billion from the U. S. over the next 13 years. The state's own income from current sources, *without borrowing*, will come to $867 million.

So the total available for road building in Michigan would be $2.582 billion over the next 13 years, or more than a doubling of the present rate.

"In other words," J. Carl McMonagle, director of the department's planning division, said recently, "without resorting to bonding . . . we should be able to meet our 10-year estimated needs ($2.347 billion) in about 12 years . . . *if* costs remain at the 1954 index and if needs do not increase."

Aerials for Expressways

Photogrammetric techniques are being used quite extensively in Ohio in the preparation of plans for urban projects, also. Densely built-up areas, in locations where expressways are to be located, make ground surveys very difficult and expensive. Aerial photogrammetry used in preparation of planimetric and topographic maps has reduced preliminary engineering time to "a phenomenal degree," the engineers say. Previously, surveys for some sections of expressways took from 10 to 12 months. Today, similar projects require only 2 to 3 months. Refinements in line and grade, when aerial photogrammetry has been used for survey work, have resulted in saving millions of dollars in right-of-way costs. This has been particularly true where the location is through an area of multi-story industrial and commercial buildings.

To improve right-of-way operations, the Bureau of Location and Design has set this new policy: As soon as line and profile have been determined and approximate right-of-way lines can be established, a field review of the project is held by representatives of the Right-of-Way Appraisal, Right-of-Way Acquisition and Design sections. This maintains design and right-of-way in proper relationship and helps to avoid major plan changes later. Often, property negotiation introduces certain problems which require plan changes, and the resulting delays are minimized if right-of-way personnel have been brought into the picture at an early stage.

The Ohio engineers are still trying to cut other corners. All together, such measures have made it possible for the Ohio department to keep its plans production high. The influx of federal funds expected will undoubtedly tax the organization extremely, but the experience gleaned in the last few years will make the accelerated program much easier to swing into line.

500% Increase

In the period 1946 to 1952, Ohio engineers produced an average of $50-million worth of construction plans per year. In 1953, they boosted production to $75 million, in 1954 to $115 million; in 1955, to $190 million; and this year to an estimated $250 million. A five-fold increase in productivity in a five-year period.

● Cutting swaths through cities will require huge sums for right-of-way. State highway departments will find it necessary to multiply their land-procurement organizations many-fold, often giving the right-of-way chief the rank and authority of an assistant state highway engineer.

Land Acquisition: $6 Billion

ANOTHER immediate task in the National Highway Program — and one of the touchiest — will be the acquisition of right-of-way for the thousands of miles of new location. Authorization of the $27-billion National Interstate System is expected to set off the largest land-procurement program in highway history. Route locations for 29,000 miles in the network as yet undetermined must be pinned down as quickly as possible and the land purchased to prevent speculation and the sort of real estate development that shoots prices sky-high.

Yet, in spite of the need for haste, the whole undertaking must be run in such a manner as to prevent scandals and public protest and with justice to the property owners.

It will be a tremendous job. Before it is over, the jargon of real estate will have become intrenched in the language of highway engineering. And the "blue book" of property values will have become as familiar a tool to some departments as the design manual.

Million Acres to Buy

It has been estimated that 85% of the Interstate System will be built upon entirely new location, and that a million acres of land must be purchased for new right-of-way. Right-of-way for the $27-billion super-highway network will amount to about 20% of its total cost. In urban areas, the proportion will go to 31% and represent an investment of more than $4.5 billion. In rural stretches, the proportion will average 11%, with the estimated cost nearly $1.5 billion.

In total, that means that the land on which the System will be constructed will cost a probable $6 billion.

The land and cultural development which right-of-way agents will have to appraise will be of infinite variety. In urban areas, particularly, each mile may confront them with dozens of unique situations.

To carry off the program successfully will require fast action along a number of fronts, including:

- The training of a vast army of men, *post-haste,* in the complexities of right-of-way acquisition policy, real estate appraisal, legal procedures, and negotiation techniques. In some states, right-of-way departments will be expanded to twice their present size.

- The complete revamping of highway law in some states to make immediate possession possible and to expedite for future use.

- The launching of a penetrating public relations program by many states to win public understanding for right-of-way takings and to prevent wholesale protestations against the chosen locations.

Some States Lack Access Control Laws

These states have law containing all elements of an adequate controlled access:

Arkansas
Florida
Indiana
Iowa
Kentucky
South Dakota
Washington
Wyoming

These states have some law containing some elements of controlled access:

California
Colorado
Connecticut
Delaware
Georgia
Idaho
Illinois
Kansas
Louisiana
Maine
Maryland
Massachusetts
Michigan
Mississippi
Montana
Nebraska
Nevada
New Hampshire
New Jersey
New York
North Dakota
Ohio
Oklahoma
Oregon
Pennsylvania
Rhode Island
Tennessee
Texas
Utah
Vermont
Virginia
West Virginia
Wisconsin

These states have authority by virtue of court decision and constitutional provision:

Minnesota
Missouri

These states have no adequate law:

Alabama
Arizona
New Mexico
North Carolina
South Carolina

Blueprint—

• The development of checks and double-checks against collusion and under-the-table negotiations and to prevent possibility of scandal.

The highway departments have never before been faced with such a huge right-of-way program. Many staff men aren't familiar with the complexities involved.

One state highway official, thinking about the problem, said last month, "We are going to have to get a lot of men into this work in a hurry. They will have to be men who are intelligent, shrewd and conscientious — and absolutely trustworthy.

"We will have to negotiate for most of this land; we couldn't get court actions on such a volume for years. That's why the job will call for men who can talk with property owners easily, explain the situation and handle them gracefully."

Are these men available? Writing in the magazine, *Right of Way*, recently, Editor Robert R. Stone declared:

"The right-of-way profession *is not* ready for this huge program and *will not* be ready unless our employers and our co-workers in the engineering profession recognize the problem with which we are confronted and immediately join us in an all-out preparedness program."

The writer further recommended that 1) an all-out effort be made to interest young college graduates in the work, and 2) that the highway departments initiate intense in-service training courses.

It isn't necessary to put engineers in this work some administrators believe; good men of other background usually do as well. Outside appraisers are frequently available, too, and can be used, particularly in cases where the departments anticipate court action.

In another area too, states will want to move fast. That is, to obtain legislation permitting them to tie up right-of-way well in advance of construction and before the land is developed or speculation has inflated prices.

Through advance purchase, the designation of ultimate right-of-way widths, the master plan, subdivision control and other zoning restrictions, further real estate development of the right-of-way can be checked. Unfortunately many states still don't have adequate legal tools.

Legal Tools Needed

David Levin, chief of the Bureau of Public Roads' Land Studies Section, has said, "Almost one-half of the states are unable to obtain possession of right-of-way when the need is greatest.

"A review of the highway laws in force today" he said, "reveals that only 14 states can acquire land for future use, and many of these laws are not entirely adequate."

Aside from statuatory authorizations, the judiciary in only six states have approved the acquisition of property for future highway use.

Some state laws, adequate in an earlier era, permit acquisition of right-of-way strips far too narrow for modern highways. Only a few designate procedures for relocating families.

Last year, a number of state legislatures considered legal methods their highway departments might put to work. Three states enacted legislation designed to alleviate the problem.

Under the direction of the Highway Research Board, a unit of five lawyers is compiling the state highway laws on this subject. In time, they expect to produce model acquisition and "immediate possession" laws to help state legislatures in the drafting of such tools.

Financing advance purchases of land is another possibility. The revolving fund scheme has worked well for California. Four other states have established funds for future right-of-way, and a score of others are considering it.

Meanwhile, the rapid development of suburban real estate around the cities adds a particularly urgent tone to this problem. Highway engineers who want to locate their urban links of the Interstate System through these areas are watching the cost of right-of-way rise daily.

The Fallon bill which authorizes the National Interstate System, contains some potent remedies. Under its provisions:

• A state may request the Secretary of Commerce to acquire land, including control of access from adjoining lands, for Interstate System projects. However, the Congressmen stressed that the provision is to be used *only* if the state is unable to "swing the deal" itself.

• The Secretary of Commerce may advance Interstate or other system funds to a state for advance right-of-way purchases, provided that actual construction is to follow within five years.

The Bureau of Public Roads is wary of using these provisions except as an expedient.

Others point out, also, that it is "bad political science" to push Uncle Sam too far into this activity. The states should have their own tools for right-of-way acquisition, and they should obtain them as quickly as possible, they say.

Another facet of the right-of-way job facing the state highway departments is that of public relations. In no other activity is the department thrown into the limelight so frequently. Right-of-way scandals have rocked many a department severely in the past and endangered the most carefully planned highway programs.

Before a large corporation moves a plant into a community, it sends a public relations advance man ahead to prepare the residents for the dislocations involved. Highway departments will do well to take a leaf from their notebook. In a program this large, there are likely to be a few right-of-way scandals. But a good public relations program can soften

the blow, and prevent a lot of unfavorable publicity.

All these angles complicate the right-of-way job involved in the National Interstate System and other federal-aid projects.

Finding personnel to man the right-of-way job and training them, seeking new legal tools for easy acquisition, obtaining the funds for advance purchasing, and check-mating potential scandals spell out a tough and tricky assignment. It will be to the credit of the highway administrators if they can push the National Highway Program safely past this obstacle.

California Shows Them How

IN the last ten years, California has *quadrupled* its construction volume. During 1954 and '55, the state highway department built more free roads than any other state in the Union.

There is another story in how the engineers have been able to acquire the right-of-way for such a high level of road building. In the light of the right-of-way chore facing Eastern engineers, this one is worth re-telling.

"The ability to acquire right-of-way," declares State Highway Engineer G. T. McCoy, "depends on four main factors:

- A basic framework of highway law which permits sound advance planning.
- The availability of funds.
- Completed plans detailing the right-of-way to be acquired, and
- An adequate staff to accomplish the appraisal and negotiation."

The California department has all four factors in its favor — but only because it went out and got them. Together they have enabled the department to step up land acquisition quickly and efficiently — *and* to save millions of dollars in the process. Here's how it works:

Making Advance Planning Possible: The department has, as its first asset in the right-of-way job, a sound long-range road program, based on a comprehensive needs study. Thanks to this plan, engineers know what the up-coming projects are. They can map their right-of-way attack well ahead of actual construction.

Making Advance Purchase Possible: The next step after advance planning calls for availability of funds for advance land acquisition. Here, California has done some pioneering.

In 1952, the state highway commission authorized the expenditure of $10 million for advance purchase of right-of-way. The objective — to pin down routes for future freeways and stymie real estate development which would boost the price of the land substantially. In 1954, the commission authorized another $20 million for this purpose and incorporated the total authorization in a revolving fund. The department could use the money for land purposes, but had to plough it back into the fund when construction and right-of-way appropriations were later made for the project.

To date, the department has spent $31 million from the fund and saved the state $160 million in higher property costs. The land it purchased for $31 million in advance would be worth $191 million today — *six times as much* as when purchased just before construction.

In addition to saving the state money, the availability of funds with which to acquire right-of-way has cut the lead time significantly, eliminating a bottleneck between planning and actual construction.

Making Plans Available: At the next stage, California runs into the common engineering shortage, hampering the preparation of plans detailing the right-of-way to be acquired. So, the right-of-way program turns on the success achieved in getting the plans out. Steps to speed plan preparation have included all the up-to-date techniques: Supplementing the engineering staff with technicians, maximum use of aerial photography; developing a a method of computing earthwork directly from contours and by use of electronic computers; and utilizing numerous shortcuts in actual plan preparation.

Developing a Right-of-Way Manpower Pool: California's aggressive land purchase program calls for a large staff — close to 1,000 people, including nearly 400 appraisers and negotiators. These people had to be recruited and then trained — a demanding job in itself. But the effort has paid off handsomely.

These are the vital elements in California's right-of-way program. She will capitalize on all of them to get the up-coming federal-aid construction program under way quickly.

With continued emphasis on long-range planning, further development of new techniques, an accelerated training program and a nominal increase in staff, the state expects to expand its right-of-way operation in time for a construction volume that will double again within the decade ahead.

It is possible to eliminate right-of-way acquisition as a botttleneck. California is showing them how!

● There will be tremendous local pressures from many communities to convince state engineers that standards for the Interstate System can be "reasonably" reduced for "special" instances.

Blueprint—

R-W: Big Business

Right-of-way acquisition is a big part of the state highway department program in California.

Some 9,109 transactions were concluded in 1954 at a total expenditure of $84.3 million, of which $76.6 million was for highway right-of-way, $2 million for utility relocation, and $4.1 million for departmental overhead and operation. (This is compared to a construction budget of $103 million.)

The year's activities exceeded 1953 transactions by 57%, with only an 18% increase in personnel.

About 309 right-of-way agents were employed. Of the 8,341 parcels acquired for highway right-of-way, less than 2% had to be acquired through court proceedings. The rest were successfully negotiated.

The department did a thriving business in property management, leasing out 2,787 units on acquired right-of-way for nearly $1.3 million.

Cities "Starting From Scratch"

ONE of the most vocal and effective organizations in the campaign to push a national highway program through Congress this year has been the American Municipal Association, representing 12,000 municipalities. It is easy to understand why. About 68% of the federal funds will go for construction of the National Interstate System. And more than 50% of the money for this 40,000-mile network will be spent within urban areas if done under a need formula. In dollars and cents, the cities stand to pick up $15 billion worth of new Interstate highways within the next 13 years. In addition, they will share in the increased federal aid for primary system routes.

Some 6,687 miles of the System will be constructed within metropolitan areas. Many will take form as 6 and 8 lane, high-speed expressways pushing to the heart of the business districts or sliding around the city periphery. There is no estimating the salutary effect these radial routes, by-passes, inner and outer loops will have on the economic well-being of the cities involved, and indirectly on the nation's economy. Traffic congestion on city streets will probably never become a thing of the past, but construction of these modern facilities will be a long step toward restoring freedom of movement within and through the 209 American cities of over 50,000 population which the Interstate System links.

With this influx of federal aid on the city street scene, the immensity of the urban highway problem comes sharply into focus. Here, where such a large share of the money will be concentrated, the right-of-way costs are steepest, the engineering most complex, the construction most difficult. More than just financially speaking, the city traffic jam will be a tough nut to crack in most municipalities.

And just as apparent as the preponderance of need in the urban areas is the realization that *the cities are least prepared to put the federal money to work.*

Only a handful have made the comprehensive studies necessary to insure that funds will be spent to a long-range plan, where the needs are greatest; just a few have priority programs; and even fewer have projects ready to roll. There are tedious route location jobs to be done in the cities — an exacting engineering effort — and an impressive right-of-way acquisition program, but these considerations are academic until the "master-planning" has been accomplished. The cities are truly "starting from scratch."

It takes as long as 4½ years to plan, agree on, design and complete plans for a large expressway. The consequence is that, except in isolated communities, it may be months before the impact of the National Highway Program will be felt where it is needed the most — within urban areas.

There are two ways, highway and municipal leaders believe, by which the city job can be speeded up. They are these:

- There must be developed a much closer relationship between state highway departments and city officials. Urban links of the Interstate System and expressways on state routes will be cooperative projects, demanding the most congenial relations between these parties.

- The cities must take the initiative in appraising their total transportation needs; must come up with master plans into which the big highway projects will logically fit. Without such scientific planning, the big, new expressways could compound, rather than solve, the cities' traffic jams.

Lack of liaison between state and municipal highway engineers has hampered, more than anything else, developments in urban areas. The fault lies on both sides. Rural-dominated state legislatures have followed a policy of neglecting city needs in putting new roads through rural areas. It wasn't until 1954 that the federal government specified that certain monies *must* be expended on state highways within cities. (There is still no federal-aid urban "system.") The result is that the work of state highway departments in many sections of the country has been largely devoted to inter-city routes, rather than in-city projects.

Authorization of the National Interstate System and its many urban links will push the state highway departments into the city picture deeper than heretofore. Their's will be the responsibility for design, contract-letting and inspection except where city or county departments are delegated part of the work. The cities' jobs will be to approve location and design which will mesh with the total traffic problem.

In many states, engineers are acquainted with the higher costs and greater complexities of expressway projects. Top policy makers in the state departments will be tempted to allocate funds to build long inter-city stretches, where the work comes easiest, rather than tackling segments of the tougher urban projects as they go along.

Urban Divisions Needed

One of the first and most constructive steps a state highway department can do is to establish an Urban Projects Division with major status at least equal to that now held by the Secondary Roads Division.

(When federal funds were made available for secondary road projects in 1950, Congress required the establishment of such divisions in each of the states and in the Bureau of Public Roads. The legislators have not yet required the establishment of similar divisions to provide skilled urban engineering assistance to the cities.)

In advocating the need for such units on the state level, at least, the state highway engineer of Texas, Dewitt C. Greer, has said:

"I believe that a state highway department should have a division of its organization that is staffed with men skilled in urban planning work. It should be the duty of this division to develop urban highway plans in all the major cities of the state involved."

It is under such procedures as Mr. Greer describes, that state and city

engineers will find themselves operating during the next few years as urban construction steps up. The importance of making it work cannot be overestimated, both state and metropolitan leaders agree.

E. H. Holmes, chief of Research for the Bureau of Public Roads, said last month:

"State engineers in many states dread urban work. City people have so many internal problems to solve in planning a big project. There are so many factions to please. Political considerations sometimes supercede sound engineering judgment, to the dismay of both the state and city planners.

"It seems to me that our city officials will have to make determined efforts to agree among themselves on the location and design of the upcoming expressways, and that our state engineers, on their part, must make a resolute effort to understand their problems, to be patient and helpful."

Planning Surveys Urgent

The cities' prime job at the outset of the National Highway Program is to make studies of total transportation needs, which so many cities, for lack of leadership and money, have delayed. This is a wide frontier along which transportation experts, planners, economists, and municipal officials must work together. Comprehensive origin-and-destination studies have been made in more than 100 cities since the war, but some are very much out-dated because of suburban development and other changes within that period. There is a 20% turnover among families in the average community every year, and the traffic desire lines established 10 years ago may not be valid now.

A National Committee on Urban Transportation was formed recently to produce a manual which will help city officials to get the facts they need to develop long-range programs. Some 160 transportation experts have pooled their experience in this project. They have drafted a fact-finding guide. Six cities are conducting pilot studies now to test the techniques recommended by this group.

Down in Phoenix, Arizona, one of the test cities, the first meeting of officials to launch the pilot study there last month found city, county, state and federal field representatives in eager attendance.

"That is the way we have got to get together," Mr. Holmes said, "if we are going to crack the urban traffic jam. This isn't just a city's job. These are federal funds; they are to be administered by state agencies; and county interests are frequently involved. It's going to take leadership all up and down the line to translate the National Highway Program into specific local projects, but, particularly, leadership on the part of city engineers, who know their own needs better than anyone else and who stand to show immediate benefits."

● Boston has made a start with its Central Artery which skirts the business center. The Interstate System construction program will include 6,687 miles of urban segments. These will be designed to solve local congestion as well as serve through or bypassing traffic.

The Contractors Are Ready

THE American construction industry, during World War II, revealed a capacity to expand that set the world back on its heels. Now the roadbuilders, vital segment of this industry, is about to get a chance to "show its stuff."

The authorization of a National Highway Program will challenge the highway men with their grandest opportunity to mobilize men, machines and materials in an endeavor that stirs the imagination. The next 13 years will provide ample opportunity for highway contractors to move close to full production and — if potential bottlenecks like the engineering shortage are eased — at a rapid pace.

Highway construction has risen by leaps in recent years — from $2.5 billion in 1953 to $3.7 billion in 1954, to $4.6 billion in 1955, and to an estimated $5.7 billion this year. *Production, in other words, has more than doubled in three years and still, contractors are operating at less than 50% capacity.*

It was because of this potential that Congressmen gave so little attention in the recent debate to the fear of runaway costs. In spite of a doubled market since 1952, competition has pushed the road construction cost index down 6% since then.

An average of 5.3 contractors bid on federal-aid primary jobs last year, the Bureau of Public Roads reports. As many as 19 contractors bid on some projects and low bids were as much as 25% under estimates.

Contractor Compacity Polled

The best analysis of the industry's ability to handle the big road program was released last month in a series of "task force" reports made to Congress by the American Road Builders Association. According to ARBA, all segments of the industry can expand fast enough to permit activation of the National Highway Program at a rapid rate, but contractors, particularly, are able to shoulder the new work load without strain.

The information compiled from

● Contractors today have the heavy, high speed equipment — or know where they can get it — to meet any highway construction demands.

Blueprint—

Contractors Estimate of the Productive Capacity That Could Be Achieved in One, in Three and in Five Years

(Billions of dollars)

Period	Earthmoving	Surfacing	Structures	Other	Total Highway Construction Contracts
Present	2.0	2.5	2.0	0.8	7.3
In 1 year	2.6	3.1	2.4	1.1	9.2
In 3 years	3.6	4.1	3.3	1.4	12.4
In 5 years	4.5	5.4	4.2	1.8	15.9

(From ARBA Task Force revised report)

Material Requirements Highway Construction (1)

	Unit	1955 $4.6 Billion Program Level 1000's	For each $1.0 Billion Increase in the Program Level 1000's
Cement	bbls.	58,700	16,000
Aggregates	tons	403,100	76,415
Bituminous Materials	tons	5,853	995
Lumber	mbm	385	87
Timber Piling	l. f.	12,575	2,823
Steel	tons	1,938	510
Structural	tons	983	278
Wide Flange Shapes	tons	444	125
Standard Shapes	tons	211	59
Bearing Piles	tons	96	27
Sheet Piles	tons	39	12
Plates	tons	193	55
Reinforcing	tons	807	212
Paving (2)	tons	118	31
Bar	tons	689	181
Corrugated Metal Pipe	tons	148	20
Reinforced Concrete Culvert Pipe	tons	2,640	512
Cement for R. C. Pipe	bbls.	2,900	564
Wire Fabric Reinf. for R. C. P.	tons	60	12
Clay Pipe and Tile	l. f.	8,100	2,039
Petroleum Products	gal.	651,840	122,794
Explosives	lbs.	90,190	18,345
Structural Steel Fabrication Capacity	tons	847	240
Signs	each	380	83

(1) These requirements do not include the materials used on highway maintenance.
(2) Mostly wire fabric but includes some bar mat.

Estimate of Value of Work Produced per Man-hours of Labor on Highway Construction Contracts

Type of Work	Value of Work Produced per man-hour of labor
Earthmoving	$ 7.91
Surfacing	10.49
Structures	8.85
Other Highway Construction	7.55
All types	8.11
Average (1)	9.11

(1) This average was obtained by weighing the value of work produced per man-hour of labor for each of the first four types of work in accordance with the amount of each type involved in highway construction put in place by the contractors.

(From ARBA Task Force revised report)

Contractors Estimates of Expanded Productive Capacity That Can Be Achieved in Varying Periods

Period	Total Highway Program Level (in billions)	Volume of Highway Construction Contracts (in billions)	Equipment Requirements (in billions)
In 1 year	$11.5	$ 9.4	$3.1
In 3 years	16.9	13.1	4.3
In 5 years	19.8	15.4	5.1

(From ARBA Task Force revised report)

data submitted by 3,000 contractors, added up to the following facts:

• Contractors worked at only 49% capacity last year, when highway contract work amounted to $3.6 billion.

• They could complete $7.3 billion worth of construction this year. (Actual volume will run to $5.7 billion.) And they could quickly boost production to $9.4 billion in 1957, to $13.1 billion in '60 and to $15.4 billion in '62.

• Labor supplies are adequate. In 1948, it took 128,000 employees to put a billion dollars' worth of new road in place. By 1955, thanks largely to equipment developments, it took only 67,000 men for that much construction. There were 500,000 men available for road construction at the end of 1955. This manpower pool is sufficient to carry out some $8.8 billion worth of contract construction work in a year, for a total highway program of $10.4 billion. Normal population increases will provide enough manpower to support a $12.3-billion program in five years.

The National Highway Program is particularly attractive to contractors because of its long-range features. For the first time, federal aid will be au-

(Continued on page 109)

New Publications

LAND ACQUISITION REPORT. Land Acquisition, 1955. Highway Research Board Bulletin 113. Includes the annual report of the Committee on Land Acquisition and Control of Highway Access and Adjacent Areas, summarizing 1954 developments in the fields of the committee's interest. Also included are papers presented at committee sessions held during the Board's annual meeting, January, 1955.

Two of the papers concern the problem of roadside regulation — "Roadside Protection Through Nuisance and Property Law," by J. H. Beuscher, and "The Nebraska State Zoning Agency," by J. Edward Johnson.

The former contains an analysis of the nuisance concept and indicates its possible application to present problems of roadside and right-of-way encroachment. The latter sketches a specific state experience with zoning at the state level, for a special purpose; and that practice may provide some cues to a possible application of the device for highway purposes.

"Right-of-Way Problems on Urban Expressways," by Edward A. Bielefeld, describes the operations of the Milwaukee County Expressway Commission under recent enabling legislation. "Highways for New Urban Patterns," by Tracy B. Augur, makes a plea for cooperation between highway designers and state and local planners in planning our highway program.

Price $1.80, remitted to the Highway Research Board, 2101 Constitution Ave., Washington, D.C.

HIGHWAY TRANSPORTATION IN TENNESSEE. An engineering appraisal of all roads and streets in the state and recommendation for the future. (Limited distribution). Automotive Safety Foundation, 200 Ring Building, Washington.

EXPERIMENTAL CONCRETE PAVEMENTS. Highway Research Bulletin 116, comprising two papers presented at the Board's 34th annual meeting, January, 1955. Report on pavement research project in Indiana by W. T. Spencer, Harold Allen, and Preston C. Smith; and on pavement research project in Ohio by Charles W. Allen and L. D. Childs.

VERTICAL SAND DRAINS FOR STABILIZATION OF EMBANKMENTS. Contains 5 papers, presented at the Board's 34th annual meeting, January, 1955.

For copies of above bulletins, write

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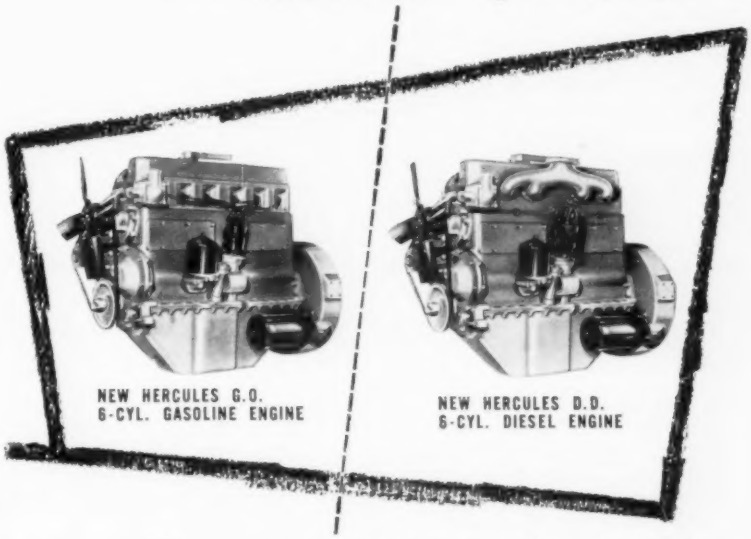
. . . what's the first thing to look for?



Of course, some people look at the "outside" of an engine and see only a nice shiny paint-job. But that's not too important. Other buyers look at what's "inside" an engine. That can be very important. However, we think a buyer should also look at what's "back of" an engine. That's why we at Hercules Motors Corporation guard the enviable reputation we have earned in more than 41 years of engine building experience.

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the Highway Research Board, 2101 Constitution Avenue, Washington 25, D.C.

SOIL-CEMENT LABORATORY HANDBOOK. Issued by the Portland Cement Association; containing up-to-date information on testing practices is now available.

This completely rewritten booklet includes modifications in practice which have reduced testing time by two-thirds in recent years. Among recent changes discussed are the short-cut procedure for sandy soils, simplification of wet-dry and freeze-thaw tests, and rapid methods of testing soils for small projects.

The handbook is an essential aid to engineers testing soil-cement.

Copies are available free on request in the U.S. and Canada from the Portland Cement Association, 33 West Grand Ave., Chicago 10, Ill.

EFFECTS OF TRAFFIC CONTROL ON STREET CAPACITY. Bulletin containing four papers presented at the 34th Annual Meeting of the Highway Research Board.

"Capacities of Narrow Streets with Manual Control and Signal Control," by Oscar Sutermeister, discusses a field survey of capacities at intersections for Fort Belvoir, Virginia.

"Capacities of One-Way and Two-Way Streets with Signals and with Stop Signs," by Alexander French, covers a study of traffic at four intersections while the traffic signals were in normal operation.

"Starting Delay and Time Spacing of Vehicles Entering Signalized Intersections," by Richard M. Bartle, Val Skoro, and D. L. Gerlough, reports on an experiment intended to measure some typical values of spacing and starting delay.

"Effect of Parked Vehicle on Traffic Capacity of Signalized Intersections," by Richard M. Bartle, discusses an experiment to evaluate quantitatively the effect of a single parked car in an intersection approach.

Price: $0.90. Address the Board at 2101 Constitution Ave., Washington, D.C.

SUBSTRUCTURE ANALYSIS AND DESIGN. By Professor Paul Andersen, University of Minnesota; The Ronald Press Company, 15 East 26th Street, New York 10, New York, 336 pages, price $7.00.

This revised edition, designed for students and practicing engineers, includes new data added to cover advances in the field of foundation engineering. The book approaches substructure engineering from the designer's viewpoint rather than that of the soil technician or construction engineer.

DATA ON ESTIMATING. Contractors, engineers, estimators and others concerned with construction estimating will be interested in Construction Report No. 432, a 704 page volume written by W. Earle Roche, Construction Consultant, 128 Western Avenue, Glendale 1, California.

This is a complete estimating system rather than a book. Published in limited edition and including estimating forms for preparing estimates of project costs.

The system involved in this book, representing the author's long experience, is illustrated by numerous examples of construction plant costs; work item costs; general and indirect cost items; summarization of cost; cost adjustments, profit allowance; write-up; pricing of competitive proposals; extensive classified construction work; check lists; broad glossary of construction terms and other data.

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Blueprint—

(Continued from page 106)

thorized over a longer than two-year period. The uncertainty that has attended year-by-year state highway construction will be greatly reduced. Contractors will be able to plan ahead, experimenting and expanding where the peculiar talents of the individual firm seem to promise better rewards through better efficiency.

Work volume will be more likely to expand more generally around the country, the federal aid providing a cushion against the vascillating market created by the starts and completions of shorter state and city programs, or a reconstruction of localized turnpikes.

Authorization of the 40,000-mile National Interstate System will set off a series of high-type, multi-lane projects, which, like the big turnpike jobs, will permit the widest use of fast, heavy equipment. There will be a tendency for the states to let as large contracts as practicable to save both money and engineering. There will be plenty of competition for such projects, particularly among firms that have cut their teeth on the toll roads. Emphasis here will be on equipment know-how and fleet management.

There is little fear that the big federal-aid program will throw too much work on the market in a hurry and push prices sky-high. But there is a danger that hasty design work on the part of the states or consultants will lead to costly errors in engineering.

Another factor that will permit lower construction prices is the proper scheduling of contract lettings. If contracts can be advertised considerably in advance of lettings, contractors can investigate job requirements and availability of materials much more thoroughly. The result will be less padding for contingencies.

No one doubts that with so much money coming onto the market in such a hurry, there will be a constant threat of scandal and honest error. The public deserves the full benefits of the competitive bidding system, and highway administrators and contractors' associations will need to work together to preserve the confidence of the tax-paying public.

Latest ARBA Estimates on Equipment

Description	Equipment Units Available for Highway Contract Construction as of January 1, 1956	Additional units Required for $1.0 Billion Net Highway Contract Construction(1)
Construction Machinery and Allied Equipment		
Tractors, Crawler (2)	33,000	4,500
Tractors, 2 and 4 Wheel (Contractors type)	9,300	3,000
Scrapers, Hauling (All Types)	17,200	3,200
Off-highway Hauling Equipment (End, Side and Bottom Dumps)	11,200	1,800
Power Cranes & Shovels	16,500	3,000
Motor Graders	15,100	2,500
Rollers, All Types	13,000	2,500
Loaders, Front End, Wheel	6,500	1,600
Ditchers & Trenchers	1,210	250
Hydraulic Hoists & Dump Bodies (3)	(70,000)	(16,000)
Air Compressors, Portable	13,750	2,250
Batching Plants, Concrete	4,000	300
Concrete Mixers, Portable	5,200	1,200
Contractor Pumps	41,500	2,340
Concrete Pavers	1,125	150
Concrete Spreaders	1,525	175
Concrete Finishers	1,525	175
Truck Mixers & Agitators	7,300	1,500
Asphalt Plants, Portable	2,000	200
Bituminous Pavers (Spreaders-Finishers)	3,040	300
Bituminous Distributors, Truck Mounted	6,500	250
Crushing & Screening Plants, Portable	2,300	250
Miscellaneous Units (10%)	20,928	3,144
Subtotal	233,703	34,584
Motor Vehicles		
Pickups & Autos	11,825	2,600
Trucks, 1½-3 Tons	42,350	9,600
Trucks, over 3 Tons	38,720	8,500
Trucks, Miscellaneous	4,050	1,800
Subtotal	96,945	22,500
Grand Total	330,648	57,084

(1) For annual work volumes in excess of $5.8 billion.
(2) Including attachments and power control units.
(3) Not in total, included as integral parts of tracks and off-highway hauling equipment.

Will We Have the Equipment?

AS IN other branches of American enterprise, the productivity of of the roadbuilding industry has been boosted by a constant striving for faster, larger, more automatic equipment. Highly efficient construction machinery, intellgently managed, has made possible some amazing economies in time and manpower.

It is little wonder that in appraising the potential capacity of contractors to handle the multi-billion-dollar National Highway Program, industry spokesmen should inquire about the availability of equipment.

There is going to be, they found, no general shortage of tools to do the job.

The ARBA task force on equipment determined that it takes $1 worth of equipment to perform $2.03 worth of highway construction. When applied to the $3.6-billion worth of work completed by contractors last year, this formula reveals that slightly less than $1.8 billion worth of equipment was used.

However, this constituted only 76% of their equipment inventory. Contractors actually have $2.2-billion worth of equipment (plus about $.2 billion available by rental) with which they can currently tackle the big road program. This fleet would make pos-

The 1957 ARBA Road Show, returning to the industry scene after a nine-year lapse, comes at an opportune time. A record-breaking attendance of contractors and officials is expected at the big exposition in the Chicago Amphitheater next January 28 to February 2, to appraise the newest in equipment.

Blueprint—

sible the completion of $4.9 billion worth of contracts, which, with force account construction, right-of-way and engineering costs, would amount to a construction program level of $6.1 billion in 1956.

Contractors indicated, however, in the ARBA report that under favorable conditions they could put $3.03 worth of work in place with a dollar's worth of equipment. If these favorable conditions (full and continuing work load) could be attained, then a $7.3-billion volume of highway construction could be performed by contract this year — far more than the $5.7 billion volume expected.

It is interesting to note, in the ARBA report, that the investment in equipment per dollar of work declines progressively as the size of the contract increases.

This increase in the productivity of equipment, the report stated, is because of "the higher degree of mechanization of the larger contractors, their ability to use the best machine for the job, and the fuller utilization of equipment because of the larger amounts of work they have under way at any one time."

It is quite likely that during the next decade under the National Highway Program, equipment will become even more ingenious and more productive. The large projects about to be launched will undoubtedly become the proving ground for equipment innovations and new equipment management techniques that will make roadbuilding as different in 1970 as it is different today from 1910. There is room for more automation and mass-production techniques in the roadbuilding process. The big program ahead is expected to give every opportunity for equipment designers and contractors to significantly boost the per-man and per-dollar output of the industry.

Concrete, Steel-'Tight Squeeze'

ONE of the dismaying problems of highway construction right now is a well-established shortage of some materials. First, it was portland cement; now it is steel.

In the face of these shortages, how can the greatly expanded federal-aid program be successfully superimposed?

The cement shortage has been most pronounced in the New York-New England area, in the Southeastern part of the country, in the central area and in the Mountain states. This spotty condition will continue, the industry's spokesmen say, even though over-all production will be slightly more than adequate for this year's construction program.

The year 1957 is supposed to yield some definite relief, however, as production gets under way in some of the new cement plants being constructed around the country. Production of cement will be up to 381 million bbl. by the year's end — an increase of 22% in two years — and will support a highway construction program of about $7.8 billion. By 1959, cement output will hit 400 million bbl., or enough to permit a road building program of $9 billion per year along with other cement demands.

Structural steel is also in tight supply, and the shortage is not expected to ease for another year. Orders, at an all-time high are coming into the fabricating mills 50% faster than tonnage can be moved out, one source has reported, and the back log has soared to more than 2.4 million tons (equivalent to 10 months' production at the January rate).

Some highway departments are redesigning bridges for concrete construction and prestressed, and pre-cast concrete units are getting more attention.

What about the long-range steel supply?

Highway construction in 1955 required 790,000 tons of structural steel and consumption this year is expected to hit 1 million tons. The ARBA task force on materials believes that unusually heavy competition from other industries for steel shapes has caused the current shortage, not lack of production capacity. Even so, the steel mills expect to add another 1 million tons capacity in 1957.

Available to road builders next year, the steel men say, will be some 2 million tons of shapes, enough to support a program of $10 billion per year, well above the $7-billion possible program in 1957.

Bituminous materials are flexible in supply and no difficulty is anticipated in meeting demand for the highway program. Road construction takes only about a third of total bituminous production. The industry can double its output, and the increase would be double what would be needed for an $11 billion highway program.

Welded wire fabric production was at only 63% capacity last year. Potential output is expected to provide enough for a $7.5-billion highway construction program next year.

Aggregate production was 821 million tons in 1955, and a survey of commercial producers of crushed stone indicates that the industry can, if need be, boost production this year by 39%, next year by 66%, in 1958 by 97%

(Continued on page 113)

● High-volume, precision crushing of aggregates is a major task in building the new paved network. Mechanically the industry is ready. Aggregate sources will sometimes pose local problems.

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Birmingham, Ala.	4-0364	Columbus, Ohio	AM 8-8631	Jacksonville, Fla.	EL 6-4167	New Orleans, La.	CA 6341	St. Louis, Mo.	PR 3-2600
Boston, Mass.	LO 6-7080	Dallas, Texas	RI 5601	Kansas City, Kan.	MA 1-4400	New York, N. Y.	OR 9-0330	Salt Lake City, Utah	DA 2-2405
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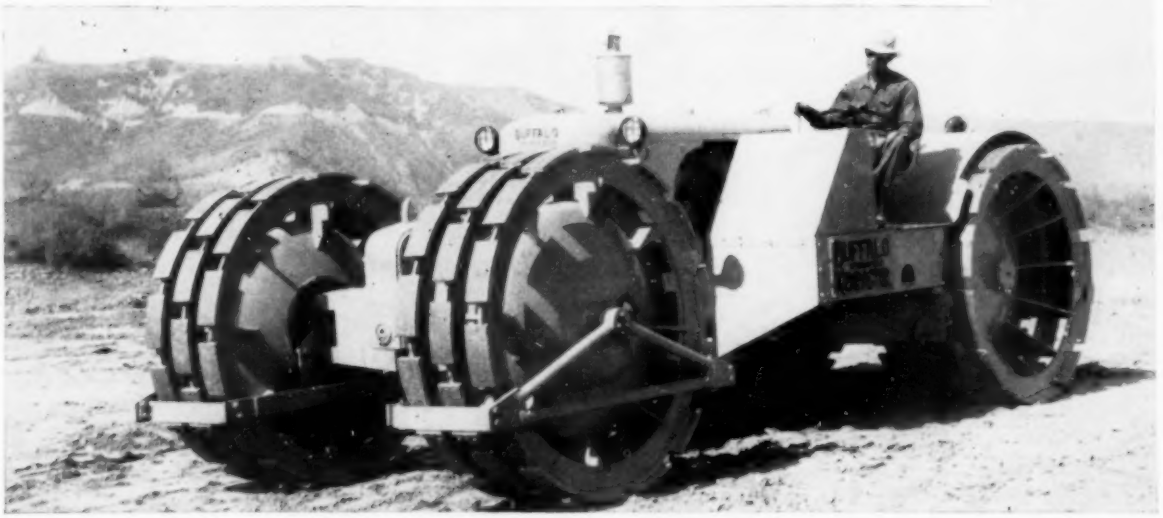
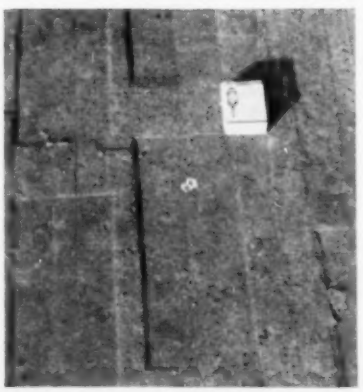


for Guy F. Atkinson Company on $1,736,000 Ventura-to-Ojai highway construction job

To meet density specifications and *speed* compaction, Guy F. Atkinson Company of South San Francisco, California, uses the Buffalo-Springfield K-45 Kompactor on this project between Ventura and Ojai, California.

Material before compaction on the Ventura-Ojai highway job. (Pack of cigarettes shows comparative size.)



After 3 passes by the K-45 Kompactor. Note surface uniformity. (Cigarette pack for comparison.) Density specifications also have been met in record time.

Operating at *fast* speeds, 4 to 5 mph, the self-propelled, highly maneuverable K-45 cuts compaction time substantially from that normally required. It further shortens time by giving compaction to meet specified densities with *fewer* passes.

The K-45's "Interrupted Pressure Principle" design places heavy steel pads in staggered rows around each of 4 large diameter wheels. *All* compaction effort is directed downward with minimum displacement on entering and leaving the compacted area . . . gives a better finished surface.

Send now for Bulletin S-64854. See your nearest Buffalo-Springfield distributor for a demonstration on the job.

The Standard *of Comparison*

BUFFALO-SPRINGFIELD ROLLER COMPANY
SPRINGFIELD, OHIO

. . . for more details circle 194, page 16

(Continued from page 110)

in 1959 by 109%, in 1960 by 119%.

Corrugated metal pipe was produced at the rate of 320,000 tons last year, of which 60% went into highway work. An expanded road program would require 20,000 tons per $1 billion expended.

Reinforced concrete pipe producers can meet any demand the highway departments make, representatives say.

In all these materials industries, spokesmen have assured the road builders they will expand wherever necessary to meet demand for their product. Long-range financing will assure a steady high volume market.

Blueprint—

Designing for Multi-Lane Freeways

FOR years, highway designers have looked at old inadequate roads that follow buffalo trails and groaned with frustration. Lack of money has kept highway departments in the makeshift engineering era, limiting improvements to widening and re-widening old roadways, patching, and, here and there, cutting off a corner or eliminating a railroad crossing at grade.

What we should do more often, engineers have agreed for a long time, is to abandon the old, hopeless routes or relegate them to a secondary role, and build highways to modern geometric standards on entirely new location.

Now, finally, with the authorization of the National Interstate System, the American motorist will begin to see "a new kind of highway." The big toll roads have given an inkling of what much of the Interstate System will eventually be like. But even some turnpikes do not measure up to the high standards being considered for the more heavily traveled parts of the system. The modern, "free-wheeling" facilities on the Interstate System will be specially designed for the up-to-date car and with the traffic volume of 1976 in mind. They must be built for the future, when traffic may be more than double what it is now.

This means, first of all, that the new roads often cannot be tied to the old, obsolete locations, with the curves and the dips and the encroaching hot-dog stands. They will strike out across the country-side in bold sweeps, and cleave through congested urban areas without a stop sign. It is estimated that 85% of the network must eventually be built on new location. This is what makes the new program so satisfying to the highway engineers who know the economic and safety gains that will accompany such a break with the past.

Design-wise, the new Interstate highways will prove an engineering challenge. This backbone segment of our 3.3-million-mile street and highway system will be planned to carry passenger cars at a speed of 70 mph in rural areas, 50 mph in the cities, and 50 mph through mountainous terrain. Built-in capacity, full control of access, and advanced geometric design will be the keys to all design thinking.

Here, briefly, are some of the ultra-modern features of the Interstate System.

- Most of the system, about 28,000 miles, would be four-lane construction. Some 2,700 miles would be six- and eight-lane, and 7,000 miles would be two lane. (See map.) This does not include the 2,300 miles of urban links recently designated, much of which will probably be wide expressways.
- Roadways would be divided on routes carrying more than a certain number of vehicles per day, probably 5,000.
- Lanes would be 12 ft. wide minimum. Shoulders would be 10 ft. wide or wider, except in mountainous areas (6 ft.).
- Opposing roadways would be 60 ft. apart in flat terrain, 30 ft. apart in rolling country, and 15-20 ft. in urban areas. A 4 ft. dividing strip would be

YESTERDAY Thousands of miles of highways like this will be relegated to secondary status, as multi-laned facilities are blazed on new location. The first problem is to revamp state laws to assure control of access and permit speedy land acquisition.

TOMORROW Most of the nation's larger cities will be tied together with access-controlled facilities. Even the Shirley Highway near Washington, D. C., will not come up to some of the geometric design requirements.

Building the National Interstate System

Earthwork, 25% of the cost.

Surfacing will take 24%.

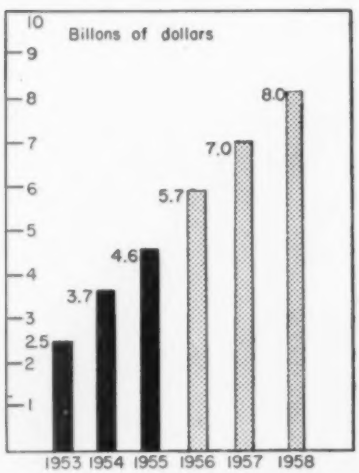
Structures, an estimated 31%.

Right-of-way costs will take the remaining 20% due to the need for wide new locations.

permitted on long structures, in the mountains or in difficult urban locations.

- Grades would not be more than 3% in flat country or 5% in rolling terrain (6% in extreme cases).
- Right-of-way requirements are 250-300 ft. through rural areas and up to 200 ft. in the cities, including frontage roads where needed.
- All cross traffic would be carried overhead or beneath much of the system — with sensible modifications in sparsely traveled areas.
- Bridges, designed for H20-S16 loading, would be wide enough to carry the full shoulder width except in the longest spans (over 150 ft.).

The engineering and construction involved will boost the National Interstate System into the ranks of the world's greatest wonders. Some idea of the immensity of the job can be realized from considering just one completed segment — the New York Thruway.



● How the highway construction problem will continue to climb.

The main route of this project alone (427 miles), required 161,000 man-years of work. It was estimated that on this job:

- Engineering would require 2,400 men for 4 years.
- Construction would require 18,000 men for 4 years.
- Materials production would require 20,000 men for 4 years.

The Thruway called for design and construction of 525 bridge structures, including 90 river crossings and 370 highway grade separations. The contract items included 80,000,000 cu. yd. of excavation, 270,000 tons of steel, 8,900,000 bbl. of cement, huge tonnages of aggregates.

It is estimated that 25% of the cost of the 37,700 miles of Interstate System so-far designated will be in grading, 24% in surfacing, 31% in structures, and 20% in right-of-way.

Route locations have been approved for nearly 11,000 miles of the 40,000-mile System. This includes the already constructed toll roads and free roads that now meet, or can be brought up to, Interstate standards. One of the chief chores for state highway departments within the next few years will be location and right-of-way acquisition for the other 29,000 miles.

By the time this System is completed, 100 million vehicles may ride the roads, and travel statistics will have doubled. The Interstate System because of its inviting adequacy will probably carry 35% to 40% of the intercity traffic load.

Realizing this, highway leaders are determined to build the network to high design standards. There have been arguments on the design policies since the System was authorized a decade ago, but now it is shaping up as one of the toughest controversies facing highway administrators.

Many traffic engineers are convinced that the system must have controlled access throughout, except where clearly unnecessary. The design engineers want sufficient right-of-way obtained at the outset to make possible the very best geometric design. "We have to think way ahead on this project," a Bureau of Public Roads official said. "We have to build for permanency."

The AASHO, organization responsible for standards determination, is insisting that compromises be fought every step of the way. Alfred E. Johnson, executive secretary, and former state highway engineer of Arkansas, declares:

"State highway engineers are going to be brow-beaten by local interests all along the location of the System to modify here, and compromise there. They just must not do it.

"We have to build permanency into this project or it will be billions of dollars down the drain. In some urban areas, particularly, engineers will be locating the road on the last available right-of-way. They will have to safe-guard that investment religiously.

"This means we must be sure of our desire lines. We must be cold-blooded in determining final location —

(Continued on page 117)

Goes places a standard station wagon can't . . . carries up to 50% more payload!

Take a good look at the new Dodge *Town Wagon*—the ideal low-cost vehicle for your business! It's a double-duty carrier of passengers, cargo, or *both*. And with Forward Look styling it's as handsome as it is versatile!

The *Town Wagon* is built on a rugged ½-ton Dodge *truck* chassis, giving you extra ground clearance for off-the-road driving. It's powered by either the famous Dodge L-head Six or the new Power-Dome V-8.

With seats in place, one model carries six passengers, the other eight. In the six-passenger model you've got about 90 cubic feet of load space in the rear compartment. The same amount of space is available in the eight-passenger model with the rear seat removed. You can also take all extra-passenger seats *out* of either model, leaving clear, unobstructed room for a big, truck-size payload of 1575 pounds.

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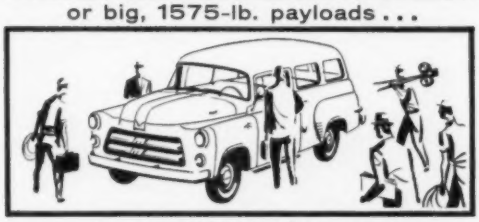

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Planning better roads

by **INTERNATIONAL SALT COMPANY, INC.**—America's largest producer of salt

Stabilizing Shoulders with Rock Salt Costs Less . . . Gives Added Safety

Highway officials in many states have found that stabilizing road shoulders with rock salt is economical for two reasons. First, rock salt is relatively low in cost—and even with lower-grade materials, it helps provide better-wearing shoulders. Secondly, shoulders made with rock salt provide substantial savings in road maintenance. These shoulders have high density, so the aggregate is not readily blown or eroded away. And they actually protect the roadway itself by preventing water from seeping under the pavement edge.

From the safety standpoint, rock-salt-stabilized shoulders have the necessary load-bearing hardness to support emergency traffic in all weather. Soft-shoulder accidents are eliminated—and blinding dust is no longer a hazard. These modern shoulders also provide excellent drainage, so that water, snow and ice will not collect on the road surface.

To show how simple—and economical—it is to stabilize shoulders with rock salt, here is an actual step-by-step story of how this method was used on a U. S. Highway with a high traffic count. For safe, efficient stabilization of the shoulders, Sterling Rock Salt, produced by International Salt Company, was chosen.

1. The first step was to scarify and mechanically mix the shoulders to a depth of 4". Bank-run dirt with good clay content was added, as well as ¾" No. 2 stone, until proper mixture was attained.

2. Then, 6 lbs. of Sterling Rock Salt per square yard was spread on the shoulders. Application of this rock salt was by rotary spreader. After this process, materials were again dry-mixed.

3. Next, the shoulder was thoroughly wetted down. After wetting, soil was again mixed mechanically. Additional wettings were needed throughout this procedure, so that soil had optimum moisture content.

4. After mixing and wetting, all the materials were then bladed to a proper level for rolling. To provide for adequate drainage of water, a slope of at least one-half inch per foot was maintained on the shoulders.

5. Final step was rolling with rubber tires. Because rock-salt-stabilized materials compact more than unstabilized materials, the 6" depth of loose material was compacted to about 4" by rolling.

This stabilization procedure varies with particular soil and road conditions. For expert advice on how stabilization can work in *your* area, contact International.

FREE TECHNICAL ASSISTANCE ON ROAD STABILIZATION

International Salt Company will be glad to help you work out an effective, economical rock-salt road-stabilization program for your system. There's no cost or obligation. Just contact your nearest International sales office.

For further technical information on rock-salt stabilization, write for International's free series of booklets, "Better Highways." Address: International Salt Co., Inc., Scranton 2, Pa.

Sales offices: Atlanta, Ga.; Chicago, Ill.; New Orleans, La.; Baltimore, Md.; Boston, Mass.; Detroit, Mich.; St. Louis, Mo.; Newark, N. J.; Buffalo, N. Y.; New York, N. Y.; Cincinnati, O.; Cleveland, O.; Philadelphia, Pa.; Pittsburgh, Pa.; and Richmond, Va.

FOR ROADS, INDUSTRY, FARM, AND HOME—

STERLING SALT

PRODUCT OF INTERNATIONAL SALT CO., INC.

. . . for more details circle 244, page 16

Blueprint—

(Continued from page 114)

and we must have control of access.

"Whenever a motorist drives onto a toll road, all that he is actually getting for his money is control of access. The greatest benefits of fast, safe travel stem from that one feature."

AASHO approved standards for rural sections of the System 11 years ago, and urban standards are currently being finalized through association committee procedures.

• *Dramatic Benefits.* It is difficult to measure the benefits that can be expected from completion of a 40,000-mile Interstate System, linking America's cities and penetrating almost every section of the country. However, if the highways are built to the engineer's standards, the results will become obvious.

A good example of how a modern Interstate link produces economic benefits is the New York Thruway.

• The fatality rate on the Thruway was only 2.83 deaths per 100 million miles of travel last year, compared to a national average of 6.4.

• Travel time and operating costs for trucks have been cut dramatically. General Electric has found that its trucks have averaged 10.6 mph better time on the Thruway than the older routes, saved 14.2 gallons of fuel, made 298 fewer gear shifts and 69 fewer stops on an average across the state.

• Real estate values have risen sharply on adjacent property. Fultonville was cut in half by the new road, but the desirability of its location just off the highway gave the village "an economic rebirth." The tax rate has dropped from $33 per $1,000 of assessed valuation to $19 because of new enterprises.

• The Thruway has stimulated economic development at numerous points along its length. Sites have been created for many light and medium industries which plan to utilize the facility's fast-transportation features.

• Individual motorists can speed safely and comfortably from New York City to resort areas of upper New York state in a fraction of former time.

• The multi-lane, access-controlled highway is still going through a design evolution. The California freeways, and other examples of advanced geometric design are actually test roads. Their performance as traffic carriers will be guides to designers of Interstate system relocations.

Can We Profit from Experience?

"In some quarters there has been a tendency to feel that certain design standards proposed by the Bureau of Public Roads were unnecessarily high. Such high standards, say these critics, may be fine in theory, but they simply are not practical.

"Perhaps the best answer to such critics is to point out that a large part of our present highway deficiencies are due to halfway measures. Often these compromises were unavoidable in the circumstances — but as viewed now, they certainly did not represent the best highway practice. We must profit by our past mistakes and build adequately for the future."

C. D. Curtiss, Commissioner
Bureau of Public Roads

"The Long Wait" – Is It Nearly Over?

THE American motorist has been waiting for the green light a long time. Is "The Long Wait" nearly over?

By mid-summer, if Congress completes its expected action, highway construction will move into a new high-volume era — up to $7 billion the first year, easing off at about $8 billion for a few years and maintaining that level or moving even higher for the next decade.

The hoped-for result — a slow but steady closing of the gap between highway construction and the highway needs of an automotive age.

Actually, the full needs are still indeterminate. Last year the Bureau of Public Roads compiled the estimates of need submitted by the 48 state highway departments. The grand total was dismaying. It would require, the bureau said, $101 billion worth of roadbuilding to put the nation's highways in shape for the traffic of 1964 (or 1974, in the case of the National Interstate System).

What the bureau did not clarify at the time was that this is only the beginning. Since then, it has been discovered that a number of states grossly under-estimated their needs. Some completely omitted the costly projects so important to their cities. And on

• The engineers are ready with the technology for an expanded road job. The accentuation will be on good planning and management, by both highway agencies and contractors.

No Interstate Jobs for 2 Years?

What's the time schedule for getting the National Interstate System underway?

A responsible Washington highway leader believes it will be two years before earth is turned on all but a very few Interstate System jobs.

"It will take that long for the states to get to the construction plan stage. First, they've got to make comprehensive traffic and engineering studies. . . Remember, less than 11,000 miles of the 40,000 have been located. Then, they've got to turn out a vast engineering job (under an engineering shortage), fight out location and design, and acquire the right-of-way.

"The rural sections of the System will come easier, but there's still two years of work before construction.

"Contractors will do all right in the meantime. Federal aid will be boosted substantially for the other systems and volume will boom just as fast as it has for the last three years."

top of the $27 billion estimate for construction of The National Interstate System must be added a more realistic cost of constructing the 2,300 miles of urban links authorized since then by the BPR.

Two years from now, when the new more detailed and complete needs studies are released, the impact is quite likely to make the proposed road program "look like peanuts."

To appraise the future volume of road building, one must focus on the future of the automobile. The road is not an end unto itself. It is constructed only as something for vehicles to run upon. The history of the modern highway in America is the history of the automobile — except that roadbuilding has fallen several years behind — and the future of the highway is the future of automotive travel and transportation.

The future volume of roadbuilding beyond the first few predictable years of The National Highway Program depends, also, on the future of trucking.

The growth of trucking has been spectacular. In 1925, there were 2¼ million trucks on the road. Today, there are nearly 11 million. And in another 20 years there may be 20 million.

In 1954, the truckers paid $1.7 billion in state and federal highway taxes. With the linking of user tax revenues to construction authorizations, the well-being of highway transportation becomes increasingly pertinent to highway men.

The roads of 1902 were inadequate for inter-city motor vehicle travel, just as the city street patterns of today are inadequate for in-city automobile traffic. In both periods, lack of modern facilities prevented full utilization of the vehicle's speed and ease of handling.

Just as the future of highways is largely dependent upon the predominance of the automotive vehicle, so the future of the automobile and truck have much at stake in the National Highway Program.

New York expands road program by $126,000,000

Governor Harriman early in May announced authorization of a new $126,000,000 state highway program. The plan was tentative, pending approval by Congress of federal highway legislation, which would set the rate at which federal aid would apply in this state.

This new plan is in addition to the $92 million the state had already planned to spend during the current fiscal year. The new plan would involve spending $35 million in state money taken from the surplus piled up in the fiscal year ended March 31, 1956. Also, there would be $25 million in federal aid currently available, $60 million in prospective federal aid and $6,000,000 in city funds.

What Kind of Highways Ten Years From Now?

What will be the result after a decade of renovating the American highway system?

Albert Bradley, chairman of the board, General Motors Corporation, made these predictions at the National Highway Users Sixth Highway Transportation Congress last month:

"Here are some of the dreams in which I think we can indulge, with justifiable hopes of making them come true, if we proceed with courage and imagination.

- "Cars, trucks and busses will travel throughout the country on an almost completely modernized Interstate System with a degree of safety, convenience and economy now possible only on a few routes. And we will have the reassuring knowledge that this key roadnet is substantially ready for the critical demands that a national emergency would impose upon it.
- "Within cities, urban links of the Interstate System and most other major arteries will be limited-access expressways. Stop-and-go driving will be largely a thing of the past.
- "Traffic control, too, will have made great strides. Freed from much of the burden of devising stop-gap measures, the traffic engineers and police should be able to do a more scientific and effective job of expediting traffic movement.
- "Downtown parking in cities will no longer be a problem. There will be plenty of space at reasonable prices in efficient, well-located parking structures. Curb parking in busy areas will be as outdated as hitching posts and there will be a great increase in off-street facilities for truck loading.
- "Transit systems will continue to be an essential and important element of urban transportation. They will provide still better service and will operate on a much healthier financial basis.
- "The safer and freer movement of traffic afforded by better highways will be further enhanced by virtually uniform traffic laws throughout the country.
- "The traffic accident rate will be much lower. Part of this gain will stem from better highways and further advances in vehicle safety. But the biggest gain will come from far better driving of 1966 — primarily as a result of greatly improved driver training, driver licensing and traffic law enforcement.

"Utopian as it may sound today, I don't believe my suggested outlook for highway transportation ten years from now is unduly optimistic. As a matter of fact, it's entirely possible that unforeseen developments in technology and public administration may even make this forecast rather prosaic and conservative.

"But one thing is certain: Whatever happens will depend largely upon the intelligence and aggressiveness of the follow-through in the states."

Highway Estimating Methods

By George E. Deatherage
P. E. Construction Consultant,
Lake Worth, Florida

Mr. Deatherage, author of this series on highway cost-keeping, has developed an 8-volume "Manual of Advanced Construction Management" for readers who are interested in more details of cost-keeping and the many related subjects in highway contracting business management. Please address your inquiry to George E. Deatherage and Son, P. O. Box 921, Lake Worth, Florida. Many contractors are finding this manual useful in a training course for superintendents and project managers. It is written primarily for these supervisory employees as an aid in better equipping them for taking on larger responsibilities and improving their management techniques.

III—Job Overhead

The two previous articles in this series dealing with the indirect costs or "Job Overhead," presented "Reminder or Check lists" covering possible items to be estimated under the heading of "General Expense;" subdivided into items of "General Conditions" and "Staff Overhead." These, as with the general equipment expense items now to be discussed, are those which apply directly to the job under estimate and are not to be confused with the "Main Office Overhead" — which is the cost of doing business whether or not the contractor has work.

A good many contractors will estimate the job overhead along with contingencies — at a percentage of the estimated labor, productive equipment and insurance cost. Many use 15% for this figure which, of course, is nothing but an educated guess. Such methods are not in harmony with the quantity survey method of estimating which is the basis of all good estimating and business practice.

This article on "Job Overhead" will deal with the most important category of "Tools, Equipment and Supplies," presenting a "Reminder or Check list" on "Equipment" as a work sheet to set down or check off needed items to be posted later to the estimate sheets.

In presenting this list of possible

(Continued on page 122)

General Expense

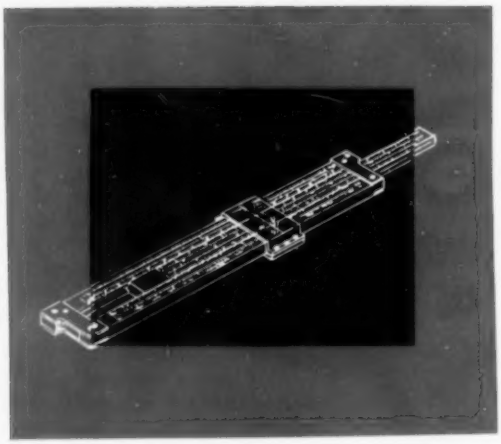
REMINDER & CHECK LIST

CLASSIFICATION
Misc. Equipment
State Rd. No. _____ Project No. _____ Date _____ State Project No. _____
Other _____
Estimator _____ Checked _____ Appv'd _____
Cont. No. _____ Location _____ Sheet No. _____

Cost Code	Description	√	X	–	Notes
3-10'	Air Compressors				
3-11	Air Receivers				
3-12	Air Lines & Hoists				
3-13	Air Motors & Hoists				
3-14	Air Locks				
3-15	Aggregate Plant				
3-16	Aggregate Storage				
3-17	Asphalt Plant				
3-18	Asphalt Pumps				
3-19	Asphalt Tank Cars				
3-20	Asphalt Heaters				
3-21	Attachments, Tractor				
3-22	Barrows Wheel				

● Suggested form sheet for making up the reminder list of equipment published on the following pages.

THE "SPECS" TELL THE STORY



What do "standard equipment" and "rated capacity" of heavy-duty trailers really mean? Since manufacturers' standards may differ, we invite close attention to Dorsey specifications. They bring out two important points:

When we say a trailer is "completely equipped" we mean just that. Each model comes with lights, brakes and other items needed for highway use, and tires are full-sized for capacity loads.

Dimensions of main beams, cross members and other structural members will show any engineer that the rated capacity of any Dorsey model is conservative, providing a big margin of safety.

This means that a "20 ton" Dorsey will carry at least 20 tons with ease, day after day, even over rough terrain.

This means that when operating conditions are not ideal, it's safer to rely on Dorsey hauling equipment.

MODEL HTS LOW BED

20 Ton capacity — *Weighs Only 8,250 pounds*
(also available in 15, 25, 30 and 35 ton capacities)

Although as much as a ton lighter than other trailers of comparable capacity, high-tensile steel main channels and close-spaced all-welded cross members give the HTS superior strength and ruggedness. Flat gooseneck provides support for blades and other loads.

TANDEM TILT-TO-LOAD

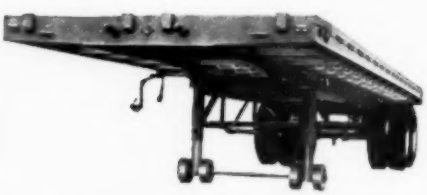
15,000 and 20,000 lb. capacities
Weights: 2,500 and 2,700 lbs.

Speed and efficiency as well as economy are combined in this versatile tilt model: it's so light a dump truck pulls it easily. Two-way hydraulic control is so precisely balanced the weight of a man will tilt it up or down. Single axle models also available.

NEW SELF-LOADING FLOAT

This trailer will actually carry 45,000 pounds *concentrated in 10 feet of its length!* The secret is the extra-deep high-tensile steel main frame that we "tailor" to length and load requirements:

14 inches deep on floats 28 through 31 ft.
16 inches deep for lengths 32 through 35 ft.



THE GIANT PLATFORM

44,000 lb. capacity — *Weight: 8,410 lbs.*

In the year since its introduction, the Giant has become America's No. 1 platform! Although as much as 2,000 lbs. lighter than other platforms, it has even greater strength.

15th ANNIVERSARY
DORSEY TRAILERS

For the complete facts on any model heavy-duty trailer, see your Dorsey distributor — or wire collect.

DORSEY TRAILERS / ELBA, ALABAMA

. . . for more details circle 209, page 16

A Super Grader for Super Jobs

IT'S "PUSH-POWER" AT THE BLADE THAT COUNTS

The world's largest Motor Grader

WEIGHS 40,125 Lbs.

GALION'S T-700 GRADE-O-MATIC* GIVES YOU TOMORROW'S PERFORMANCE NEEDS TODAY!

Its massive weight of 40,125 lbs. is balanced to permit its mighty 190 horsepower to produce tremendous "push-power" at the blade. This "push-power" at the blade means most in work production, fast cycles, and ease of operation unmatched by any other grader.

The Galion GRADE-O-MATIC* Drive makes top grader performance practically an automatic achievement. No tiresome old-type gear shift or foot clutch to operate. Effortless power shifting can be done on the go—in either direction. Engine speed AUTOMATICALLY adjusts to working or travel speed. Up to 340% torque multiplication of engine driving force is AUTOMATIC, as needed.

Every part of this GALION Super-Grader is larger, heavier, stronger, more efficient. It has been engineered to give you correct balance of weight, power, and blade pressures to produce maximum "push-power" at the blade — where power means most to move more material, in quicker cycles, with less operator fatigue.

Correct balance of power and weight in the T-700 means that its 190 h.p. can be utilized without useless, costly spinning of the drive wheels — a very important point to remember when studying the work production value of a motor grader.

You'll never believe a Galion GRADE-O-MATIC Grader does so much until you own one and put it to work.

* Utilizing a Torque Converter with Tail Shaft Governor and Power-Shift Transmission.

ESTABLISHED GALION 1907

MAIL THIS COUPON FOR COMPLETE INFORMATION

THE GALION IRON WORKS & MFG. CO.
GALION, OHIO, U.S.A.

THE GALION IRON WORKS & MFG. COMPANY
Dept. RS-66, Galion, Ohio, U. S. A.

Please send me literature on the GRADE-O-MATIC Graders checked.

☐ Model T-700, 190 H.P. (Illustrated)
☐ Model T-600, 140 H.P. ☐ Model T-500, 125 H.P.

PERSON _____ TITLE _____

FIRM _____

STREET _____

CITY _____ STATE _____

. . . for more details circle 222, page 16

Job Overhead, Equipment Check List

Here are 476 pieces of equipment, with cost code number, which must not be overlooked in figuring Job Overhead. How many of these have you already been including? How many did your estimator forget? Many will not play a role in the job you are about to estimate, but the list is still a mighty handy one — The Editors

Cost Code and Item	
3-10	Air Compressors
3-11	Air Receivers
3-12	Air Lines & Hoists
3-13	Air Motors & Hoists
3-14	Air Locks
3-15	Aggregate Plant
3-16	Aggregate Storage
3-17	Asphalt Plant
3-18	Asphalt Pumps
3-19	Asphalt Tank Cars
3-20	Asphalt Heaters
3-21	Attachments Tractor
3-22	Barrows Wheel
3-23	Backfillers
3-24	Bar Cutters
3-25	Batchers
3-26	Batch Trucks
3-27	Batcher Stone
3-28	Batcher Sand
3-29	Batcher Cement
3-30	Barricades
3-31	Barges.
3-32	Back hoe Bender Hydraulic
3-33	Binders Load
3-34	Bits Rock
3-35	Bins & Gates
3-36	Blowers Ventilating
3-37	Blasters Equipment
3-38	Blades Dozer
3-39	Booms Crane
3-40	Booms Tower
3-41	Booms Derrick
3-41	Boats
3-42	Borer Foundation
3-43	Bodies Dump
3-44	Boilers Steam
3-45	Broom St. Power
3-46	Breakers Pavement
3-47	Bridges Const.
3-48	Bridges Float
3-49	Bridges Access.
3-50	Buggies Hand Concrete
3-51	Buggies Power Concrete
3-52	Bulldozers
3-53	Burning Outfits
3-54	Buckets Clam Shell
3-55	Buckets Concrete
3-56	Buckets Tower
3-57	Buckets Dragline
3-58	Buckets Orange Peel
3-59	Bulk Cement Plant
3-60	Bulk Cement Cooling Plant
3-61	Bullclams
3-62	Bunk Houses
3-63	Carts Box Tray
3-64	Carts Power Conc.
3-65	Cableways.
3-66	Cable Cutters
3-67	Cars. Dump R/R
3-68	Cars Flat
3-69	Car Stops
3-70	Cars Tank
3-71	Caisson Locks
3-72	Carriages Drill
3-73	Camp Equipment
3-74	Caissons Floating
3-75	Cable Wire
3-76	Concrete Plant
3-77	Carry-All
3-78	Cars Muck
3-79	Cars Passenger
3-80	Caisson Schields
3-81	Cement Test Equip.
3-82	Chutes Concrete
3-83	Change Houses
3-84	Classifiers Sand
3-85	Conveyors Belt Conveyors Screw
3-86	Conveyors Concrete
3-87	Conc. Surfacing Machine
3-88	Condensers
3-89	Cooling Towers
3-90	Compressors Air
3-91	Compaction Devices
3-92	Compactors Wheeled
3-93	Compactors Pneu.
3-94	Compactors Special
3-95	Crushers Stone
3-96	Crushers Clay
3-97	Crabs Hoisting
3-98	Crushers/Screening Plant
3-99	Cranes
3-100	Crushers Portable
3-101	Crushers Secondary
3-102	Cranes Truck
3-103	Crawlers Tractor
3-104	Cranes Floating
3-105	Cutters Root
3-106	Cut off Machines
3-107	Cylinders Caisson
3-108	Derricks-Tripod
3-109	Derricks-Truck
3-110	Derricks Stiff Leg
3-111	Derricks Hand
3-112	Decompression Chambers
3-113	Disc. Plows
3-114	Ditchers
3-115	Digger Post Hole
3-116	Drag Lines
3-117	Drag Scrapers
3-118	Dredges
3-119	Dredges Ladder
3-120	Drivers Marine
3-121	Drivers Pile
3-122	Drills Core
3-123	Drills Rotary
3-124	Drills Wagon
3-125	Drills Rock
3-126	Drills Track
3-127	Drills Diamond
3-128	Drill Presses
3-129	Drills Precussion
3-130	Drills Electric
3-131	Drills Gas. Rock
3-132	Drills Air-Trac
3-133	Drills Shot Hole
3-134	Drills Exploration
3-135	Drivers Skid
3-136	Drifters Tunnel
3-137	Drivers Form Pin
3-138	Diggers Pneumatic
3-139	Distributers R. Oil
3-140	Distributers Aggreg.
3-141	Ducts Ventilating
3-142	Dump trucks
3-143	Dump Trailers
3-144	Dumpers Car
3-145	Elevators Belt
3-146	Elevators Bucket
3-147	Elevators Material
3-148	Elev. Self-Loading
3-149	Engines Marine
3-150	Engines Diesel
3-151	Engines Industrial
3-152	Engines Hoist
3-153	Emulsification Plant
3-154	Ejectors Air
3-155	Ejectors Hydraulic
3-156	Excavator Slack Line
3-157	Feeders Aggregate
3-158	Feeders Cement
3-159	Feeders Secondary
3-160	Fence & Gates
3-161	Flood Lights
3-162	Flumes Wood
3-163	Flumes Steel
3-164	Flusher Street
3-165	Float Bridge
3-166	Float Power
3-167	Forms Roadway
3-168	Forms Sectional
3-169	Form Pin Driver
3-170	Form Pin Puller
3-171	Finishers Power
3-172	Finishers Hand
3-173	Field Offices
3-174	Fire Prot. Equip.
3-175	First Aid Equip.
3-176	Furnaces Tar
3-177	Furnaces Lead
3-178	Furnaces Asphalt
3-179	Furn. Surf. Heater
3-180	Gates Bin
3-181	Gates Concrete
3-182	Gas Stations
3-183	Gantry Frames
3-184	Gantry Cranes
3-185	Generators Steam
3-186	Generators Elec.
3-187	Generators Welding
3-188	Graders Sub-Grade
3-189	Graders Elevating
3-190	Graders Form Trench
3-191	Graders Trimmers
3-192	Gradall
3-193	Graders Other
3-194	Gravel Plant
3-195	Grease Pits
3-196	Grease Trucks
3-197	Grizzley
3-198	Grout Placers
3-199	Grubbers.
3-200	Gunite Equipment
3-201	Guns Grout
3-202	Hammers Pile
3-203	Hammers Gasoline
3-204	Hammer Mills
3-205	Hammers Stud
3-206	Hammer Hydraulic
3-207	Harrows
3-208	Heaters Mixer
3-209	Heaters Asphalt
3-210	Heaters Steam
3-211	Heaters Tool
3-212	Heaters Space
3-213	Heaters Aggregate
3-214	Heaters Surface
3-215	Heaters Water
3-216	Heaters Radiant
3-217	Heaters Planer
3-218	Heaters Spot
3-219	Hitches Tractor
3-220	Hoppers Concrete
3-221	Hoppers Aggregate
3-222	Hoppers Cement
3-223	Hoists Capstan
3-224	Hoes. Power
3-225	Hoes. Back
3-226	Hoppers Portable
3-227	Hoists Drum
3-228	Hoists Scaffold
3-229	Hose Air
3-230	Hose Water
3-231	Hot Air Plant
3-232	Hot Asphalt Mixers
3-233	Hyraulic Equip.
3-234	Ice Plant
3-235	Impact Drivers
3-236	Irons Scaffold
3-237	Jetting Rig
3-238	Jacks
3-239	Joint Sealer
3-240	Joint Saw
3-241	Jumbos Drill
3-242	Kettles Asphalt
3-243	Kilns Dry
3-244	Ladders Dredging
3-245	Lathes
3-246	Loaders Belt
3-247	Laboratory Test
3-248	Latrines
3-249	Levels (Surveyors)

3-250 Leads Pile Driver
3-251 Lighting Plant
3-252 Lights Warning
3-253 Liners Ditch
3-254 Logging Equipment
Locks Air
3-255 Locks Man
3-256 Locks Material
3-257 Lofts Rigger
3-258 Locomotives
3-259 Loaders
3-260 Loaders Front end
3-261 Loaders Bucket
3-262 Loaders Scraper
3-263 Low Boy
3-264 Low Bowl Scrapers
Mandrels Pile
3-267 Manifolds
3-268 Marker Traffic
Lane
3-269 Material Elevators
3-270 Mach. Brush Filling
3-271 Magnets
3-272 Maintainers Road
3-273 Mats Curing
3-274 Meters Aggregate
3-275 Meters Water
3-280 Mixers Concrete
3-281 Mixers Mortar
3-282 Mixers Paving
3-283 Mixers Transit
3-284 Mixers Grout
3-285 Mixing Plant
3-286 Mixers Pug Mill
3-287 Mills Pug
3-288 Mills Reduction
3-289 Mills Saw
3-290 Motor Graders
3-291 Mold Boards
3-292 Move-in-Equipment
3-293 Move-out-Equip.
3-294 Mucking Machines
3-295 Needle Beams
3-296 Pavers Concrete
3-297 Pavers Asphalt
3-298 Patrols Motor
3-299 Pile Drivers
3-300 Pipe Lines
3-301 Pipe shop
3-302 Pile Fork Shells
3-303 Pipe Pusher
3-304 Pipe Plant
3-305 Power Units Gas
3-306 Powder Storage
3-307 Pontoons
3-308 Plant De-watering
3-309 Plows
3-310 Plow Mix-in-place
3-311 Planers
3-312 Plant Asphalt
3-313 Plant Concrete
3-314 Plant Aggregate
3-315 Plant Cement
3-316 Plant Pipe
3-317 Plant Steam
3-318 Platforms Truck
3-319 Plant Rd. Builder
3-320 Plant Ready-Mix
3-321 Plant Batch
3-322 Plant Sand
3-323 Plant Hot-mix
3-324 Plows Dise
3-325 Presses Drill
3-326 Power Lines
3-327 Pneumatic Tools
3-328 Pneumatic Hoppers
3-329 Prestressing Equip.
3-330 Pumps Mud
3-331 Pumps Sinker
3-332 Pumps Sand
3-333 Pumps Sump
3-334 Pumps Diaphram
3-335 Pumps Centrifugal
3-336 Pumps Concrete
3-337 Pumps Piston
3-338 Pumps De-Watering
3-339 Pumps Grout
3-340 Pumps Intake
3-341 Pumps Jet
3-342 Pumps Lubricant
3-343 Pumps Multi-Stage
3-344 Pumpcrete Remixers
3-345 Pumpcrete Lines
3-346 Pulverisors
3-347 Quarry Plant
3-348 Racks Storage
3-349 Railways
3-350 Rammers
3-351 Ramps Loading
3-352 Refrigeration Plt.
3-353 Re-Screening Equip.
3-354 Receivers. Air
3-355 Refrig-Air Plant
3-356 Rigging Equipment
3-357 Rippers. Road
3-358 Rollers Compaction
3-359 Rollers Road
3-360 Rollers Tamping
3-361 Rollers Sheepsfoot
3-362 Rollers Ditch
3-363 Rooters
3-364 Rooters Tractor
3-365 Saws Band
3-366 Saws Swing
3-367 Saws Table
3-368 Saws Elec. Portable
3-369 Saws Chain
3-370 Saws Joint
3-371 Saws Masonry
3-372 Saws Jig
3-373 Saws Radial
3-374 Saws Shale
Salamanders
3-375 Sanitation Equip.
3-376 Screening Plant
3-377 Screens. Gravel
3-378 Screens Sand
3-379 Screens Testing
3-380 Screens. Portable
3-381 Screeds.
3-382 Screeds Vibrating
3-383 Scaffolds Metal
3-384 Scrapers Road
3-385 Scrapers Bowl
3-386 Scales Truck
3-387 Scales Barrow
3-388 Service Stations
3-389 Shears Bar Cutting
3-390 Shovels Power
3-391 Shops Repair
3-392 Shops Drill
3-393 Shapers Wood
3-394 Sharpeners Drill
3-395 Shaft Heads
3-396 Shaft Sinking Plt.
3-397 Shields Tunnel
3-398 Silos
2-399 Sidings R/R
3-400 Skips Rock
3-401 Soil Sampling
Equip.
3-402 Spreaders Material
3-403 Spreaders Asphalt
3-404 Spouting Concrete
3-405 Sprayer Power
3-406 Stabilization Equip.
3-407 Street Sweepers
3-408 Stump Pullers
3-409 Strike off Power
3-410 Stand Pipes
3-411 Storage Reservoirs
3-412 Storage Tanks
3-413 Stores Construction
3-414 Storage Fuel
3-415 Surfacing Equip.
3-416 Sub-Stations
3-417 Sweepers Motor
3-418 Sweeper Blowers
Tackometers
3-419 Tampers
3-420 Tanks Storage
3-421 Tanks Water
3-422 Tampers Tile
3-423 Tampers Vibro
3-424 Templates Sub-grade
3-425 Terracers
3-426 Tire/Battery Shop
3-427 Tires/Spare
3-428 Towers Concrete
3-429 Towers Cableway
3-430 Tractors Crawler
3-431 Tractors Wheeled
3-432 Tractor Pusher
3-433 Tractor Shovels
3-434 Trailers
3-435 Trail Builders
3-436 Tarplauns
3-437 Transmission Lines
3-438 Tramming Equip.
3-439 Trailers Low Boy
3-439 Trailers Rear Dump
3-440 Trailers Platform
3-441 Transits
3-442 Trenching Machine
3-443 Trestles
3-444 Trolley & I Beam
3-445 Tires Spare
3-446 Torque Converters
3-447 Transits
3-448 Trailer Center
Dump
3-449 Trucks Grease
3-450 Trucks Water
3-451 Trucks Service
3-452 Trucks Ind. Box
3-453 Trucks Pickup
3-454 Trucks Pave. Repair
3-455 Trucks Timber
3-456 Trucks Dump
3-457 Trucks Semi-Tractor
3-458 Trucks Cement Bulk
3-459 Trucks Tank
3-460 Trucks Asphalt
3-461 Trucks Batcher
3-462 Trucks Sprinkling
3-462 Tool House
3-463 Tugs
3-464 Tool Heater
3-465 Tunneling Machine
3-466 Tools Small
3-467 Unloaders Car
3-468 Unwatering Equip.
3-469 Unloaders Cement
3-470 Ventilating Equip.
3-471 Vibrators
3-472 Vibrator Spreaders
3-473 Vibrating
Compactor
3-474 Washers
(Gravel & Sand)
3-475 Wagons Dump
3-476 Water Treat. Plant
3-477 Water Supply
Equip.
3-478 Wagon Tractor
Units
3-479 Welders Elec.
3-480 Welders Gas.
3-481 Weighing Hoppers
3-482 Well Point Systems
3-483 Welding Shop
3-484 Wells & Equipment
3-485 Winches Truck
3-486 Windlasses

needed items it might be noted, as the first inaccuracy in using 15% of the labor, equipment and insurance as mentioned above: to cover the job overhead, only the cost of the productive equipment is usually considered. This means that the small tools, construction supplies and considerable of the miscellaneous service equipment are not included. Consequently, the expense must be taken out of the Main Office Overhead, and Profit — if any.

In estimating unit production costs on highway work, it is usual to calculate the labor plus the hourly ownership operating cost of the producing unit — plus the insurance, contingencies, insurance etc. This procedure means that the production equipment (Bulldozer, scraper etc.) has its cost and operation taken care of in the estimated unit price, and is not part of the separately estimated job overhead.

The estimated hourly equipment ownership/operating cost also means that all items of expense are calculated therein, including depreciation, re-

(Continued on page 152)

Gets More

A combination of powerful "pry-out" action using breakout pads as a fulcrum for leverage and a 40° bucket tip-back *at ground level* gets BIGGER LOADS with less spillage.

Keeps More

Heaped loads are cradled closer to the machine for greater stability and can be carried at lower level. Exclusive load shock-absorber cushions the load during travel, smooths out the ride, and permits faster movement with less spillage.

Delivers More

Since you get MORE to begin with and keep MORE while traveling at higher speeds . . . with less spillage in both instances . . . the result — you *deliver* MORE. This new PAYLOADER is a more PRODUCTIVE machine which will handle more yardage at lower cost.

more yardage at lower cost...
New 2¼ yard PAYLOADER®

The new model HO is the finest four-wheel-drive tractor-shovel ever offered. All the *exclusive* features that increase yardage output enable it to handle many kinds of jobs never before practical with wheeled tractor-shovels.

It operates easier and faster, rides smoother, with or without a load, than anything near its size. It has *balanced* design and durability throughout to turn out big production day after day. If you want *proof* of its *productive capacity* and superior *performance,* ask your "PAYLOADER" Distributor for a demonstration.

Safety and Stability

The safest and most stable wheeled tractor-shovel ever built. Moving members cannot injure operator because of underslung boom arm design and positioning. With loads carried lower and closer to the machine, cushioned during travel, and with longer wheel-base, the utmost in stability is achieved.

More Production, Less Effort

Power-steering, power-brakes on all four wheels, power-shift with no clutching or stopping for range changes and good balance and riding qualities reduce operational fatigue — promote full production all day.

Digging Power

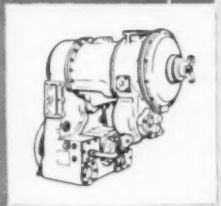
Pound for pound, the new model HO has more traction and digging power — for a wider range of ground conditions — than any wheeled tractor-shovel ever built.

PAYLOADER®
MANUFACTURED BY
THE FRANK G. HOUGH CO. LIBERTYVILLE, ILL.
SUBSIDIARY—INTERNATIONAL HARVESTER COMPANY

Torque-Proportioning Differentials *Reduce Wheel Slipping*

Another exclusive "PAYLOADER" feature which assures better traction under adverse conditions. If one wheel starts to spin, more power is delivered automatically to the other wheel.

Rugged planetary final drives in the wheel hubs, plus hypoid differential gearing keep torque low in axles, prolong life of drive-train parts as well as axles.



Complete Power-Shift Transmissions

"Complete" since ALL shifts can be made instantly and on-the-go, under full engine speed. There's NO STOPPING for a range-shift, there's no foot clutch pedal. With the forward-reverse control, the operator can "inch" the machine while maintaining full engine speed to provide maximum bucket lifting and dumping power. Torque converter drive cushions power-train shocks.

THE FRANK G. HOUGH CO.
768 Sunnyside Ave., Libertyville, Ill.
Send information on "PAYLOADER" tractor-shovels:

☐ model HO	☐ model HH	☐ model HU
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. . . for more details circle 238, page 16

GETTING THE MOST FOR YOUR EQUIPMENT DOLLAR

By H. T. Larmore

Tractor & Equipment Sales Manager — Construction Machinery Division

Allis-Chalmers Manufacturing Company

THIS subject, while always important, assumes even greater stature today in the face of a tremendous road building program, large scale water and soil conservation projects, increased logging activity and a booming building construction industry.

These programs mean lots of work for users of construction and dirt moving machinery, *but* on a highly competitive basis. Careful buying, wise selection of equipment and a practical maintenance program will go far to get more out of each dollar spent for the purchase and maintenance of construction machinery.

In addition, this effort will contribute in no small way to that ever popular result—less cost per unit of work done.

General Requirements

These statements apply to broad, basic fundamentals and to a basic type of construction machinery — TRACTORS. It is true, however, that most of the statements will apply generally to all types of construction machinery.

First of all, it is obvious that some of our buying habits have not kept pace with modern job methods and equipment. For instance, it is not unusual to find equipment being merely replaced with new equipment identical to the old without serious consideration being given to the actual present day project requirements.

It is becoming more apparent that wise buying today demands a fresh look at the jobs to be done. Is there a better and less costly method now available? How will the new unit fit into my present fleet of equipment? Is there a unit available which will do more jobs than the old one or that will be useful in the winter as well as the dirt moving and construction season? Will one unit with proper equipment do the work of two or more older units of single purpose design?

Again it's the problem of getting the "Mostest for the Leastest" and actually that's the creed and problem of any good tractor salesman, as well as the tractor industry as a whole. Only by continuous development and knowledge of your problems can we be of service to you to keep job costs down in the face of increased labor and material prices. How well that has been accomplished shows in bid prices for dirt moving today, still close to prices 15 years ago.

Type of Tractor

Should your new tractor be on tracks or rubber tires Here we must weigh the value of rubber tire travel speeds and mobility with the traction characteristics and stability for mounted equipment of crawler tracks.

Tractor Size

In crawler tractors you have a choice from 20 to over 300 hp. and weights up to over 50,000 lb. There is normally considerable latitude in selection of size, but a growing awareness that tractors worked consistently at or near overload capacity are not an economical "buy." In other words, don't send a boy to do a man's job.

Other influencing factors are size of the job, size of other fleet units, transportability, finances and operating conditions. The buyer's good judgment based on experience is of prime importance here and the equipment salesman's advice and information can be of great value.

A word for those who must write specifications and buy on bids: Tractors on the market today cannot be lumped into definite classes, and especially so when we consider the multitude of tools or equipment that can be selected for use with the tractors. With that in mind, keep your specifications broad enough and, if possible, retain enough buying latitude so that you can select the "Best Buy" offered and truly get the "Mostest for the Leastest."

Special Equipment

Now comes the problem of specifying the special equipment to best adapt the tractor to the jobs you have for it to do. We at Allis-Chalmers, for instance, have over 200 items of special equipment or accessories available for tractors. I am sure other manufacturers also have a similar wide variety. This equipment is designed for (a) added protection to the machine or the operator — heavy guards, hood side plates, cabs and

As told to the Wisconsin Road Builders Association at its annual meeting, March 19-21 at Milwaukee.

Some of the things the contractor must think about in buying, using and maintaining his earthmoving fleet for maximum profit

● Allis-Chalmers TS-360 motor scrapers and a motor grader and HD-16 tractor of same manufacture, seen in a high-speed grading operation on the Indiana Turnpike.

canopies, etc.; (b) added versatility with power take-off, belt pulley, pusher plates, etc.; (c) added performance with special track shoe widths or types; (d) added life under adverse conditions with air inlet extensions, heavy fuel and lube oil filters, etc.

Dozer or Loader?

Here again your choice is wide and the experience and trained tractor salesman can be of valuable assistance to you. At the very least he can fully acquaint you with the latest equipment developments and the latest in job methods.

I personally see a growing trend toward tools with more versatility. A good example is the front-end shovel which, since World War II, has replaced the bulldozer on many jobs — not because it does a better bulldozing job than a bulldozer, but because it and its many attachments enable it to do a good job of bulldozing — *plus* many more jobs as well: excavating, loading, crane work, bulk material handling, snow removal, ditching, etc.

Where bulldozers are the logical choice, you must decide between hydraulic and cable control — to me this becomes a buyer's option with little to guide you one way or the other except where combination units such as hydraulic rippers or cable scrapers may dictate your choice.

You also have your choice of straight or angling type dozers and here again your own job conditions or personal preference may decide.

Blade Choice

I find few jobs where any conceivable advantage of an angle blade is not more than offset by the increased cost of the angling dozer and increased wear-and-tear on the tractor, over that of a straight blade dozer. The newer, special straight dozer blades now with angling ends do a good job of bank cutting. These blades with angling ends, because of their extra length, or the extra wide loose material dozers on the market, are effective in cutting costs and increasing yardages on all types of loose material handling with bulldozers.

Land Clearing

Those with land clearing problems have the option of special clearing type dozer blades or root rakes. Such boards are usually inter-changeable with the standard dozer board for maximum utility at the least cost.

Scraper Size

Perhaps your new tractor is to pull a scraper. This is, of course, a well known tool, but the matching of tractor and scraper size is important. If you use pushers, hook to a big scraper and watch the dirt roll, but if your jobs are small and the unit works alone, keep the scraper size down so the average operator in your average conditions can easily get a good load quick and haul, dump and spread without getting stuck or struggling with the load. This speeds up the operation more than would an extra yard or two each trip and greatly reduces maintenance costs.

Miscellaneous Tools

Other chapters in this discussion should, of course, include winches, crane booms, power control units, side booms, back hoes, rippers and other well known tools, but time will permit only this brief listing. I might just say this, that tractor mounted rippers, although first introduced in the early 1930's are now becoming increasingly popular in speeding up production rates. A tool such as this on the rear of at least one tractor-shovel unit or a bulldozer tractor on each job, can easily double the production rate in many places by ripping the material before handling. This will save, in hard going, most of the abusive wear and tear on the dozer, shovel, or scraper units with a substantial reduction in maintenance costs. In addition, a ripper will extend your working season by enabling you to open up your cuts while there is still some frost in the ground.

What You Are After

Now, let's go back to the original statement that your problem in choosing tractors and equipment is simply to get the "Mostest for the Leastest." We might take this apart and ask:

1. Most Work Potential — of the kind you want done. This is over-all performance which is influenced by many other factors.

2. Most Availability — meaning least amount of down time or more working time. This involves the ability of the tractor to operate under adverse as well as good conditions — its ability to resist abuse and ability to keep going day after day without break-down, and perhaps equally important, the integrity and service and parts facilities of your equipment dealer.

3. Most Versatility — Fixed costs on an idle tractor are the same as one that is working, so this is important in reducing costs. Investigate fully with the salesman before buying new tractor equipment as they are your best source of accurate informa-

tion and their interests go hand in hand with yours. We're all in this together with one common goal — to build and maintain this ever expanding network of highways and streets at the minimum cost.

4. Most Easily Operated and Serviced — Here's a factor involving the human element which cannot and is not being ignored. Your operating and servicing personnel are extremely important to your entire operation and play a major role at times in the selection of equipment. Present day tractors and equipment have been designed with these people in mind.

Now let us see what we want the "Least" of:

1. Least First Cost — Certainly, this on the face of it is important but can often be misleading without examining other factors.

2. Least Operating Costs — You know what is involved here, but look what one versatile tractor, which replaces an extra single purpose unit and operator, can do to lower this cost.

3. Least Maintenance and Repair Costs — This over the life of a tractor is a big item and deserves a great deal of attention while selecting equipment such as tractors. Life factors, frequency of overhauls, cost of repair parts, labor involved in making major repairs as well as day to day maintenance — all these things will influence you in your selection of equipment.

Have faith in your machinery salesman, the dealer and the manufacturer they represent. Get all the facts before you buy. These people who call on you are specialists in their field and will prosper *only* by helping you select the *right* equipment for your jobs.

Flood damage emergency projects get started

The first projects for repairing damage to highways and bridges in New York State, numbering 124 jobs, have been declared eligible for State aid under the provisions of the $1,500,000 Emergency Flood Repair Bill, signed in April by Governor Harriman. This batch of jobs involves expenditure of $367,853,000, the work being scattered in seven counties.

• The Illinois Toll Road Commission has budgeted $112 million for construction and right-of-way acquisition expenditures during the 1956 calendar year. Of this amount, $50 million is assigned for construction payments, $30 million for right-of-way, $20 million for financial expense and $10 million for engineering services.

Equipment Owners' Responsibilities

By Fred S. Wimberly

Sales and Service Training Supervisor — Construction Machinery Division
Allis-Chalmers Manufacturing Company

Negligence with respect to construction equipment use, draws a large part of the operating dollar. It is the responsibility of all of us to reduce it whatever its cause.

If we hope to realize the best in profits, it will be necessary to cut our operating cost and to lengthen the life of our equipment. This can be done provided we establish some sort of a fitting program for the preservation of machinery.

The owner certainly wants to know the daily operating schedule as he plans his job. How much material will be handled? How many yards of earth will be moved? How many miles of road will be covered?

To put the question very plain and simple, what am I going to do tomorrow? If we don't know within reason what we propose to accomplish tomorrow, our operating schedule is worthless. The schedule being worthless, it is impossible to estimate any profits, as work done and cost of operating is involved in that calculation. In order to make reasonable estimates, it is necessary to know the condition as nearly as possible of our production equipment.

In order to become better acquainted with our production units, it is necessary to draft a program of care, inspection and servicing to fit the individual requirements. It is very true, care for machinery is basic, but the requirements might vary considerably, depending upon job size, equipment size, production requirements, type of work, type of material and the product knowledge of the handling personnel.

Manufacturer's Responsibility

We believe it is the responsibilities of the manufacturer first to design equipment that meets the present demands of high production output. To design it for diversified loads, for various tools and attachments. To simplify lubrication, to extend the intervals of lubrication, to make the equipment reasonably accessible. This is the trend of design with many manufacturers.

It's also our responsibilities to offer Preventive Maintenance Programs, Operators and Service Manuals, Educational Slides, and other materials that might be of benefit to the particular user and job. The dealer has these aids to offer and with continued efforts of manufacturer and dealer, I believe a good workable program of Preventive Maintenance and Schooling could be installed at all necessary places.

Owner Interest

I think the most important part of any program is for the owner principal to become conscious of its necessity and demand its implementation.

A very simple and useful program can *seem* rather complicated, impracticable and even expensive. And no doubt it will be, if we aren't willing to accept it on the basis of over-all virtues, and willing to accept a short time compromise.

It does take some time to service a piece of equipment. It is true that during this time the machine is idle. Those responsible for production are very unhappy during this shut-down period. We don't stop to consider that generally the person in charge of actual production is conscious of only the day's production and not considering the over-all jobs or job profits.

Better Maintenance

We are pleased to notice a vast improvement in the care of machinery among many users, and have been informed by those that have made a serious effort that Preventive Maintenance has paid off in reduced repair cost and increased dependability of their units. We, combined with our dealers organization, sincerely offer our services to encourage a smoother and more profitable operation.

Sureties liability

In a recent decision handed down by the U. S. Court of Appeals for the Fourth Circuit in the case of U.S. v. Phoenix Indemnity Co. 4/9/56, it was held that Sureties on performance and payment bonds under a construction contract which binds the contractor to pay "taxes legally collectible because of work" is liable to the United States for construction employees withheld income taxes and for the employees part of the social security tax.

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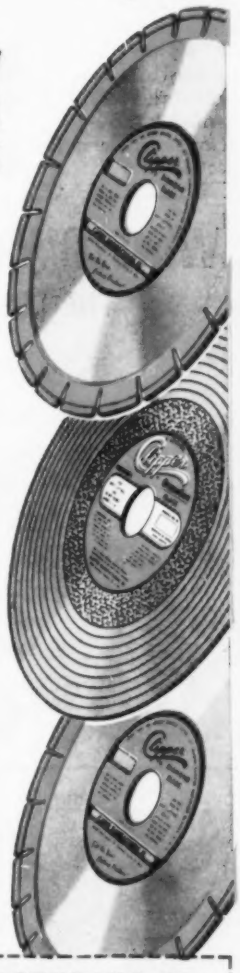

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Materials and Tests

ASTM test procedures on asphalt and chloride

Phyical tests of and the effect of water on compressed bituminous mixtures, and on bituminous coated aggregates, have been of interest in the many fields of activity of ASTM Committee D-4 on Road and Paving Materials. It has been difficult, however, to establish standard test methods for evaluating the properties involved. At the meeting of Committee D-4 in Buffalo, New York, on March 2, during ASTM Committee Week, action was taken to publish as information to well-known procedures preliminary to further consideration. The Hveem test procedures and apparatus for determining cohesion and resistance to deformation, and for kneading compaction of laboratory samples were approved for distribution to Committee D-4. Cooperative tests on the reproducibility of both of these test methods will be conducted. The Marshall Test for Stability and Flow Value of Bituminous Mixtures has been previously circulated to the committee and the comments will now be reviewed.

A method for the determination of moisture or volatile distillate in bituminous mixtures was proposed as a new ASTM tentative method, this being similar to an existing method published by the American Association of State Highway Officials (Designation T-110-42).

New methods for determining the setting properties of bituminous emulsions are under study with a report on work by the Indiana State Highway Department on one of these samples, to be included before further promulgation is planned. Reproducibility tests on the several methods included in ASTM Standard D 244 have been completed by six laboratories using six samples of emulsified asphalt. This data is now being studied preliminary to recommended changes in each of the test method sections of the standard. Thin film tests are being studied with a thin-film oven test developed by the Bureau of Public Roads and a micro-thin film test, developed by Shell Oil Co., being considered. Significant revisions in apparatus used in the ASTM standard method for penetration (D 5) to obtain better reproducibility are being considered. This pertains particularly to new requirements for the needle. Cooperative tests will be conducted using the new types of needle to establish sufficient data.

A new Proposed Method of Testing Graded Aggregate Road Mixes for Certain Water Soluble Chlorides Present as Admixes was accepted for committee letter ballot. This proposed method, being under joint jurisdiction of Committee D-4 and D-18, has already been approved by the latter committee.

C. W. Allen, Ohio department of highways, is chairman, and J. M. Griffith, The Asphalt Institute; secretary of Committee D-4, University of Maryland, College Park, Md.

New fly ash with lime specifications by ASTM

The use of fly ash with lime is covered by a new tentative specification for this type of pozzolanic lime by the action of ASTM Committee C-7 on Lime at its meeting on February 28, during ASTM Committee Week in Buffalo, N. Y. This proposed specification after letter ballot by the committee, is being presented to the Society for acceptance at its annual convention, Atlantic City, June 17-22. A round-robin series of tests will be conducted, using the proposed specification in order to establish further data. Attention will now be given to pozzolans other than fly ash.

An interesting slide-illustrated report was presented by Prof. W. C. Voss, on the research work which has been conducted on the expansion of lime. Four laboratories have been cooperating in the test program. It is expected that, following the completion of this program, clauses will be proposed for the specifications on lime which will clarify soundness of lime in mortars.

J. A. Murray of MIT, Cambridge, Mass., is chairman of Committee C-7, and the secretary is Robert S. Boynton, National Lime Assn., 925 Fifteenth St., N. W., Washington 5, D. C.

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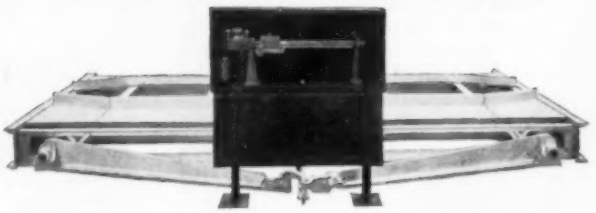

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Allis-Chalmers HD-16 crawler tractor and 315 pull scraper

Teamed to increase output ...keep jobs on the move

Here's more of everything you want in a tractor-scraper team ... a combination of advanced basic design features that cut cost and time per yard.

The HD-16 has an all-steel box-A main frame that absorbs shocks and protects the power train. A powerful Allis-Chalmers diesel engine and your choice of either torque converter or standard transmission drive, give you plenty of work power for big jobs. And with 1,000-hour lubrication intervals for truck wheels, idlers and support rollers, even under severe conditions, you can eliminate daily greasing . . . convert maintenance time into production time.

With its wide, low bowl and offset cutting edge, the 315 scraper makes effective use of the HD-16's power to get heaping, void-free loads. Wheels are inside the cutting edge for smooth loading . . . and loaded weight is equally distributed on all four wheels for fast hauling, long tire life.

This earth-moving team can give you big output plus real dependability. Let your Allis-Chalmers construction machinery dealer show it to you now.

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HD-16

with hydraulic torque converter drive
150 net engine hp
31,600 lb

with standard transmission
141 belt hp
31,500 lb

AC-315

15 cu yd struck
20 cu yd heaped
25,850 lb
cable-controlled

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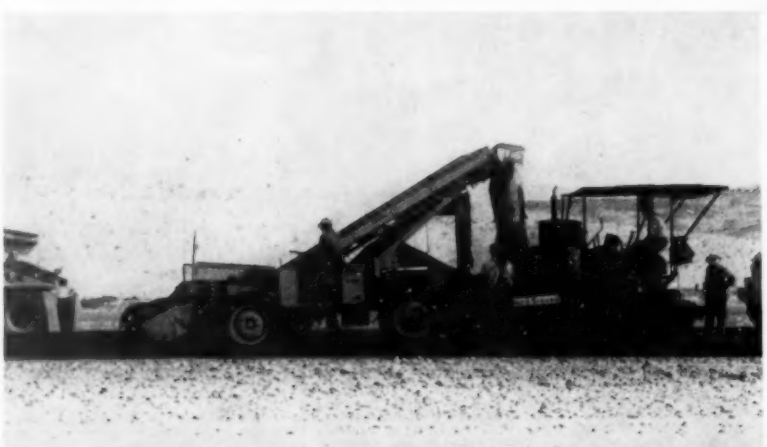


● Side view of novel paving operation, again showing how the loader handles a bottom-dumped windrow to the paver. This method kept the paver from stopping for truck back-up and pull-aways as it traveled up the road.

● New procedure to insure steady paver progress: dump hot-mix in windrows from bottom-dumps, pick-up with an Athey loader, and feed to a Barber-Greene paver.

● Pettibone Wood 54 roadmixer with D8 Cat tractor — a pair of these machines handled the base processing job here described.

New High Production Methods

ON DESERT FREEWAY

Million-gallon water days necessary in early stages. Contractor worked out high-speed methods for cement-treated base and aggregate production. Hot mix delivered in bottom-dumps and fed to paver by windrow loader. An on-the-job report to ROADS AND STREETS readers.

HIGH winds, flying sand, weather extremes and a host of other problems have joined forces to resist construction efforts north of Palm Springs, Calif., where U.S. 70-99 is being re-routed 14.4 miles through blistering desert. "Fantastic" water needs, equipment buried in sand, are among the difficulties whipped by the contractors, McCammon-Wunderlich, of Palo Alto, California.

As one of the contractor's men put it, "It was the kind of job to make a man glad to go back to mountain roadbuilding."

Necessity for rebuilding the highway through this area was obvious. The old, narrow 2-lane highway between Banning and Indio became obsolete about 1940 and has been rebuilt in stages since then as fast as funds became available. The section currently under construction was one of the worst remaining stretches. Continuing its policy of building divided multi-lane limited access highways on such major thoroughfares, the California Division of Highways moved the road over to a new straight location, designed it with twin 34-ft. paved strips, and limited the points of access throughout the section.

Design includes both usual and unusual features. In the "usual" category are such provisions as a raised earth subgrade, constructed with material borrowed along each side of the highway; 12 in. of select imported granular base material (upper 8 in. cement treated); and a 4-in. plant-mixed asphalt-paved surface covering the 26-ft. roadway and 8-ft. shoulders.

In the "unusual" bracket is a bladed dividing median, 6 in. high and 36 ft. wide, built of 3-in. minus crushed rock from Whitewater Canyon. Use of this material was specified at this location to resist wind erosion in the median area, and to establish aerodynamic currents in windstorms which will keep the paved surfaces clean. The color of the crushed rock also is expected to contrast favorably with the asphalt pavement, giving a definite safety measure.

The difficulty of establishing a major highway through barren desert is shown by the following notes on the principal construction stages.

● "Bazooka" loading device, developed by Miles & Sons, Inc., being used to transfer bulk cement from tankers to the PMCO cement windrow spreader. When this picture was made the 45-mph wind was stirring up a dust storm around the equipment.

● *Grading.* This was a one-million-cubic-yard unclassified excavation item. Approximately 400,000 cu. yd. could be handled direct by dragline casting; the remaining 600,000 cu. yd. was balanced so that hauls were not excessively long. Good production was developed by a combination of tractor-scraper work and an oversize fleet of long-range rubber-tired hauling equipment. The list of equipment which McCammon-Wunderlich employed is shown in an accompanying box. The cut sections were not more than 10 ft. deep, and fills also were not much higher, since it was flat desert country.

Earthwork, however, had several unusually interesting aspects. On the south 10.0 mile end of the project, certain characteristics of desert blow sand and light gravel made it desirable to compact this material by flooding the finished embankment with water. Although the Coachella arm of the All-American Canal passes through this general area, development of a dependable supply of water to handle hundreds of thousands of cubic yards of fill was a first-order problem. A high-producing artesian well was found on private land about 2½ miles from the job. McCammon-Wunderlich also drilled a 610-ft. deep well near the center of the job, at the edge of the right-of-way on private land; and for a short time arrangements were made to pump from a 400-gpm well near Thousand Palms at one end of the project.

Steel Pipe Was Used

All told, the construction company used 50,000 lin. ft. of 8, 6, and 4 in. pipe. This was strung down one side of the project with valves and T connections every thousand feet or closer. Steel pipe was used principally, while easily-coupled aluminum pipe was used to carry water from the valve points to the fill. Electric-driven deep well pumps were used — even on the artesian well — to maintain good pressure in the system.

The earth embankment was partly thrown up by a 4½-yd. dragline. The machine worked from a borrow pit at each side of the embankment and threw the material into the embankment toe with its 75-ft. boom. The rubber-tired hauling fleet then filled in the center portion, or did it simultaneously, after which short sections were diked off both longitudinally and laterally. The pipelines were then laid and water was turned into these areas and allowed to saturate the embankment from top to bottom.

The borrow pits at either side of the road had previously been sprinkled heavily with Rainbird heads, so that dust could be largely kept down.

At one stage during this operation, in the 1955 summer, when desert heat reached 122 degrees, the job was using 1,000,000 gal. of water per day. Normal water consumption, even in cooler temperatures, was between 500,000 and 700,000 gpd.

On the last 4.4-mile end of the project, conventional methods of compaction with moisture and sheepsfoot rollers were successful. The desert material was simply leveled in 8-in. lifts, sprinkled with 6,500-gal. pressure-type water trucks, and sheepsfoot rolled. That did the work. The normally good granular roadbuilding material found in desert floor areas of this type made an excellent grade for the new highway.

● *Subbase Construction.* Construction of the subbase was conventional for California except that long-range, high-capacity hauling equipment was used to get desert floor material from the borrow pits to all parts of the road. For help in hauling, McCammon-Wunderlich went to a firm specializing in efficient long-distance truck hauling — Miles & Sons, of Merced, Calif. This firm sub-contracted the subbase hauling, mixing of cement-treated base, and hauling of

● Motor graders finish laying out a work section of cement-treated base (this section against a bridge structure.)

bulk cement, asphalt and plant-mix.

Equipment assigned to the Miles operation includes ten special truck and trailer units totaling 30 tons capacity per unit. The units consist of Peterbilt trucks, Utility tandem trailers with special bottom gates manufactured by Western Iron Body Co., of Berkeley, Calif. These units hauled the 2-in. minus subbase material for the main roadway from the crushing plant; and also shuttled back and forth from another (portable) crushing plant in Whitewater Canyon, to bring 3-in. minus crushed rock in for the median strip.

Installation of base material was a routine operation, with water trucks coming heavily into play to put in the necessary moisture. Fast pneumatic self-propelled roller equipment then followed, with final rolling being done by steel-wheel equipment. This method was used for the initial spread of the first 4-in. of subbase material. Following that operation, the highway was ready for the next construction step.

● Cement treating in progress, showing diagonal spreading blades on roadmixers.

● *Cement-Treated Base.* Application of cement-treated base followed a general procedure which has been developed over a long period of time by the California Division of Highways and its more experienced contractors. On this job, two 4-in. compacted lifts are being handled to create 8 in. depth of cement-treated base. The work is being done as follows:

Material for the windrow is being hauled from borrow pits by the bottom-dump trailer equipment previously described, and dumped through a spreader box to make four windrows across one-half the 34-ft. paving width. The material is being dumped into four windrows chiefly to enhance accuracy. After it is dumped, a Caterpillar 12 motor grader moves in and heels two windrows of material into a single windrow, leaving two windrows to be processed. Material in each of these windrows weighs approximately 470 lb. per lin. ft. and is relatively dry.

Bulk cement for the treating operation is being hauled from the Colton plant of Riverside Cement Co., and is transferred at the job by means of a "bazooka" loader consisting essentially of a receiving hopper, enclosed screw and discharge spout. The bazooka transfers bulk cement into a Pettibone Wood cement bulker which carries material to the windrow and injects it into the base-course material at a metered rate. Cement is used at the rate of 12.5 lb. per lin. ft. of windrow on the bottom 4-in. course, and 25 lb. per lin. ft. on the upper 4-in. base course. The bulker can inject cement under characteristically windy conditions. This feature was an asset on the desert highway, because cement applied by the bulker did not blow away.

Cement-treatment mixing of the two windrows is being done simultaneously by two Pettibone Wood Roadmixers, whose combined daily output amounts to from 6,000 to 7,000 ft. per day, or 5,000 tons of material. Pulled by Caterpillar D8 tractors whose special rear-end power takeoffs are hooked to the pugmill chamber driveshaft of the roadmixers,

Desert Wind Created Some Weird Problems

What contractor did about them

Did you ever stop to consider what a simple thing such as wind can do to a desert roadbuilder? Here are just a few of general superintendent J. E. Bydler's headaches — and solutions:

1. Ruined Water Pipe: Aluminum water pipe laid along ground level, couldn't be perfect, so there were minor joint leaks. This dampened the sand. Blowing sand then stuck to the wet material underneath until it coned up over the joint. Confined sand then began to whirl turbulently under the leak, and soon wore a big hole in the pipe from abrasion.

Solution. Cement blocks used to hold each joint up off the ground, in the clear of any sand build-up.

2. Snow Fence For Sand: Beydler's crew installed a set of platform scales for truck weighing; found the scales nearly buried next morning after a bad sandstorm.

Solution. The crew installed a 5-ft. snow fence 125 ft. out on the windward side. The fence has been buried five times in three months; had to be dug out by equipment. Scales have just barely stayed in the clear of the sand toe.

3. Phantom Cross-sections: Subgrades, diked off to receive flooded water compaction, filled up to the top of dikes with sand when the winds blew sand.

Solution A. Dig the offending material off with equipment.

Solution B. Sprinkle nearby borrow pit areas to prevent wind erosion.

Solution C. Cuss the wind. A combination of all three solutions helped to pin down the phantom cross-sections.

● Tampo pneumatic roller and Littleford power broom team up here to sweep one of the approach ramps, prior to placing bituminous surface course.

● Tampo self-propelled and Buffalo-Springfield pneumatic tire roller work the cement-treated base down to specified density.

● On this long-mileage job, radio communication was indispensible. Here is superintendent J. E. Beydler using his car-mounted Motorola transmitter to send out some order.

the machines moved along, injecting the necessary moisture into the mix and blending cement base material and water in one pass. Blade-type wings behind the machines smooth

● Sprinkler at work on surface of fresh cement-treated base, a step necessary so that hydration can be properly controlled.

● A windrow of base course (soil and cement) material being deposited at a metered rate by one of Miles & Sons bottom-dump truck-and-trailer units.

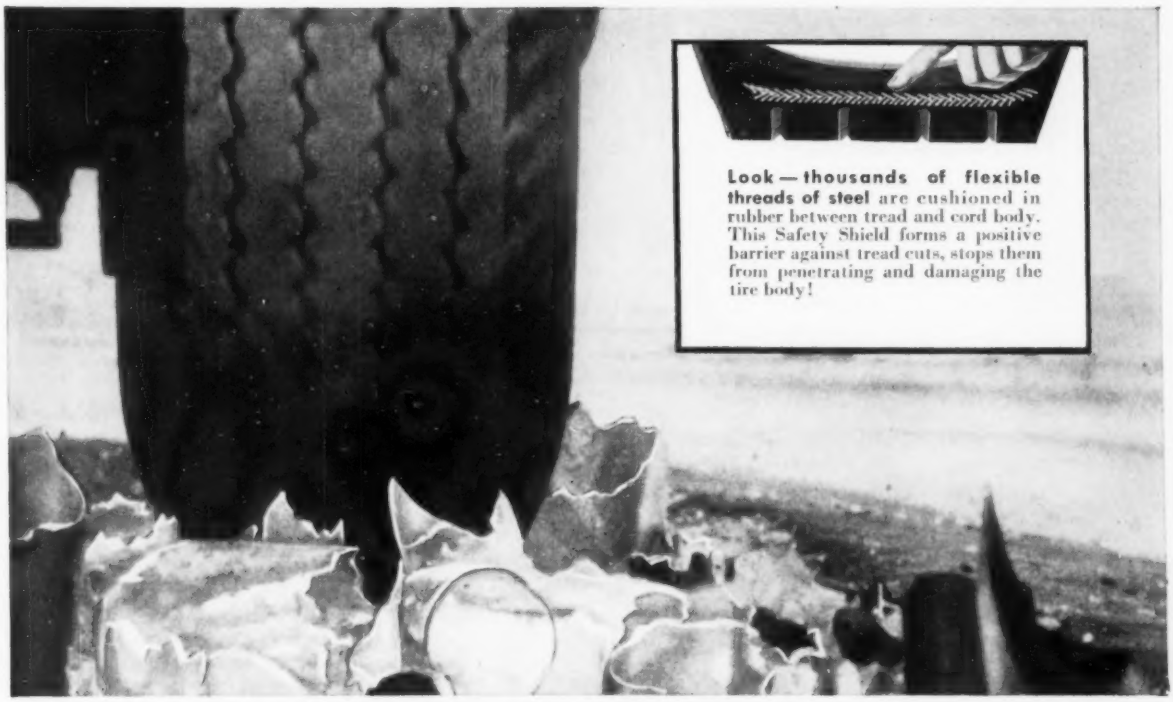
the finished material down so that only a minor amount of motor grading blading then is necessary to spread the cement-treated base for rolling.

Rolling is a combination pneumatic and steel wheel method, with pneumatic equipment used on the initial compaction. Heavy 3-wheel tandem Buffalo-Springfield steel rollers then finishes out the top. The surface is prevented from drying during this operation by frequent applications of moisture, put on by sprinkling truck equipment, after which a prime coat of asphalt emulsion is immediately applied as a seal.

(Continued on page 138)

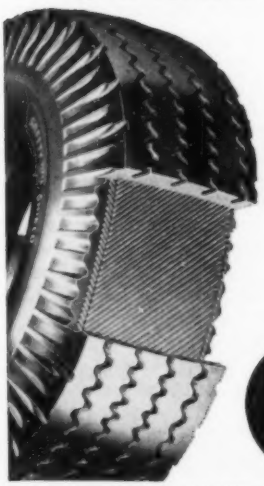
Tread Cuts Are Stopped

by new exclusive SAFETY STEEL SHIELD



Look — thousands of flexible threads of steel are cushioned in rubber between tread and cord body. This Safety Shield forms a positive barrier against tread cuts, stops them from penetrating and damaging the tire body!

U.S. ROYAL Truck Tires



You are looking at an entirely new kind of highway truck tire. It combines the strength of *steel* with full flexibility, light weight and soft ride—without increased inflation.

Because this new U.S. Royal is *invulnerable* to cuts and ruptures in the vital tread area, it gives you the longest, most trouble-free service in truck tire history. Because steel cord shields its carcass, it remains undamaged for more safe recapping, making it the most economical of truck tires.

You'll find new U.S. Royals like this cost *surprisingly little.* Ask your U.S. Royal Dealer now. And remember—you can specify them on the new equipment you buy!

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An all-new, all-wheel, all-job ON-AND-OFF-THE-ROAD TIRE— new U. S. Royal Super Fleetmaster with SAFETY STEEL SHIELD

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. . . for more details circle 299, page 16

● A successful innovation: Bottom-dumps placing hot-mix in windrow.

● Plant mix being laid down rapidly as "semis" bring it in.

High Production Methods

(Continued from page 136)

Payoff Idea: Bottom-Dump Hot-Mix Hauling

The most unusual method used in the plant-mix asphalt surfacing is its transportation by Miles & Sons Trucking Service in the same 30-ton bottom-dump semi's which this subcontractor used on subbase work. Developed during the 1955 construction season to help contractors lower their hauling costs, the method is highly productive. Up to 2100 tons have been laid in 8 hours by this method.

McCammon-Wunderlich is using a 6,000-lb. batch Standard RB plant to turn out plant-mix at high speed. Ten such batches are carried per trip by the big semi's. A plant-mix leveling course 2-in. thick is dumped by the semi through a spreader box of Miles' design. With the help of two motor graders and a roller, paving for the base course is a definite high-speed operation — and the job is good.

On finish-course work, McCammon-Wunderlich is using an Athey loader between a dumped windrow and a Barber-Greene paver. Plant-mix, transferred to the paver hopper from the hot windrow, is laid conventionally. Chief advantage of the method is that starts and stops are eliminated from the paver motion, and that bottom-dump delivery is possible on surface-course paving. There is no apparent segregation of particles because of this hauling or dumping method; in fact, segregation normal in end-dumping has been eliminated.

In one respect the desert relented regarding the plant-mix item. The same locale which had been so searing hot during the summer of 1955, stayed warm through the winter to permit asphalt paving. Operations began late in December and continued through January. There were several weeks, however, when high winds stopped the paving for days on end. An air compressor and a power broom also were necessary to remove dust from the completed binder course.

Final blade dressing of the crushed rock dividing median will finish off a fast, safe highway.

● Bottom-dump semi unit receives load of hot mix from the Standard RB asphalt plant.

● The project is under the San Ber-

(Continued on page 144)

Stop unnecessary maintenance

Stabilize shoulders with Morton Salt

- **Cut aggregate loss**
- **Check erosion and rutting**
- **Save on grass and weed removal**

You get tough shoulders that resist frost boiling and heavy storms . . . shoulders that last far longer under the pounding of heavy traffic . . . when you stabilize with Morton Salt. Stabilizing with Morton Salt not only saves man-hours and maintenance money, it also reduces dust and eliminates accidents caused by soft shoulders.

What's more, stabilizing the base course of primary roads with Morton Salt helps prevent the 9 out of 10 road failures which result from faulty foundations. It's also a fact that gravel roads stabilized with Morton Salt give more service per dollar than roads built by any other method. (Savings in aggregate alone more than pay for the salt.) You get smooth, durable, water-repellent surfaces that require minimum maintenance.

. . . for more details circle 270, page 16

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A TIRE FOR EVERY ROAD, LOAD AND CONDITION OF SERVICE

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. . . for more details circle 215, page 16

Court Decisions

By Albert Woodruff Gray

These recent decisions may have a bearing on your responsibilities as a highway or municipal official, or your rights and prerogatives as well as responsibilities as a contractor.

• • •

Maintaining streets and highways in reasonably safe condition is the duty of the city, and cannot be shifted to abutting owners or other persons unless the legislature sees fit by statute to relieve the city of this obligation.

Karom v. Altarac, 144 N.Y.S. 2d 812 N. Y., Sept. 22, 1955.

• • •

Owners of land on a public road have a right to use the road in going to and from their premises, but the road may be closed by the city without liability when other ways of access are available to such owners.

Smith v. Gagliardi, 144 N. Y. S. 2d 800, New York, October 11, 1955.

• • •

No liability rested on the state for the death of a motorist when car skidded on wet newspaper dropped five hours previously on a concrete highway. "The state is not required to discover and remove everything, no matter how trivial, from the highway within a few hours."

Acord v. State, 142 N. Y. S. 2d 813, New York, July 7, 1955.

• • •

The Board of County Commissioners were liable to the contractor in indicating the point for construction of bridge pier, 40 feet distant from place which should have been indicated. "This was the county's error and not that of the contractor. The contractor was entitled to recover for the additional work caused by this error plus a reasonable profit thereon."

Board of County Comm'rs. v. Howard, 230 Fed. 2d 561, Kan., February 7, 1956.

• • •

Promise by a general contractor, made after execution of a contract for highway construction — to pay subcontractors one-half of the additional labor cost incurred by the subcontractors' promises to employees of increased wages made upon threat of strike — was void and unenforceable. "Where A is under a contract with B, the promise made by one to the other to induce performance, is void."

Arzani v. People, 149 N. Y. S. 2d 38, New York, March 1, 1956.

• • •

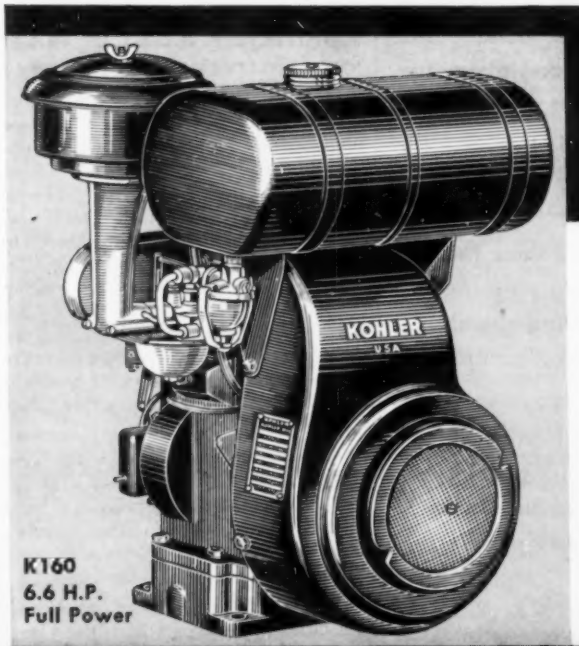
The State was responsible for damages from the collision of an automobile with a tree fallen across the state highway, when the accident occurred five hours after the highway department had received notice of the obstruction but no lights, flares or warnings had been posted nor the road closed for traffic. "The state was not liable for the violence of the storm but it had a duty to exercise a fair degree of care to protect traffic by posting adequate warning signs or closing the highway."

Battistoni v. State, 149 N. Y. S. 2d 614, New York, March 21, 1956.

• • •

When the public has used a road continuously for more than 40 years, the grantee of the land may not close the road to public use. To prevent such action "all that is necessary is an adverse use on the part of the public for a sufficient time to create a bar under the statute of limitations or such circumstances as imply a dedication of the land."

Lozier v. Bultman, 286 S. W. 2d 43, Kansas, December 5, 1955.



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Cleveland® "95" digs 10 miles for airfield lighting system at Portsmouth, N. H. Air Force Base

Morrison-Knudsen Company, Inc. and Landers & Griffin, Inc. employed a Cleveland Model 95 "Baby Digger" to good advantage in the construction of the airfield lighting system for the Strategic Air Command's 4,500-acre, $60,000,000 Jet Base at Portsmouth, N. H. The Cleveland dug approximately 52,000 feet of trench 17 inches wide by 27 inches deep for the installation of cable and duct.

The "Baby Digger" was also profitably used on the same project for the excavation of some 3,600 feet of underdrain pipe trench, approximately 2 feet wide by 5 feet deep. As the photograph above shows, much of this trenching was done in rocky, stony soil, definitely not what could be termed "easy going."

The dependable Cleveland steadily delivered good daily trench footage—as it had been counted upon to do—in spite of the rugged digging and adverse conditions encountered. Just another example of Cleveland's ability to *dig more trench . . . in more places . . . at less cost.*

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A highway in Georgia is not a "public highway" except it has been created (1) by legislative enactment, (2) by being regularly laid out and established by proper authorities, (3) by dedication or (4) by prescription.

An indictment charged a motorist with manslaughter in killing a man on a public highway. The road on which the tragedy occurred was not a public highway under this definition. The verdict of guilty was set aside.

Baker v. State, 87 S. E. 2d 44, Georgia, May 18, 1955.

* * *

The Subcontractor is entitled to payment from surety under bond on a highway project on which the surety will pay all material and labor. The Subcontractor's claim was for labor in hauling a roller for use on the work, and hauling other equipment from the job. "Labor in connection with material furnished is covered by the bond. Transporting the equipment to and from the job is just as essential as labor on the project."

Nat'l Automobile & Casualty Ins. Co. v. Adair, 292 Pac. 2d 403, Oklahoma, January 24, 1956.

Contractors aided in tax on construction machinery

Construction machinery and equipment owned by contracting firms or corporations in Massachusetts is subject to a personal property tax only in the city or town where the owner is domiciled. And such machinery is normally situated, and is not subject to taxation in any other city or town in which it is temporarily located or being used on the first day of January — according to a decision of the Supreme Judicial Court of Massachusetts (case of Assessors of the Town of Sheffield against J. F. White Contracting Company).

This decision, as noted by the New England Road Builders Association, is of considerable importance to local contractors engaged in road building and heavy construction.

It reverses the position previously taken by the Assessors of practically all cities and towns within the Commonwealth, that any construction machinery or equipment located within the town on the first day of January is subject to a personal property tax, unless the owner could show that a tax on the same equipment had been assessed and paid in some other community within the Commonwealth.

"Most dependable units we've ever used!"

Gar Wood 20-ton truck crane gives Frank L. Marino Corp. the right combination of heavy-duty performance and multi-job mobility. Like all "75's" it has heavy-duty, conical hook double rollers; power steering; direct manual controls; optional hydraulic coupling; easy convertibility for work with a complete line of attachments.

—says Frank Marino, Frank L. Marino Corp., Brooklyn, New York

Here's another leading contractor who depends on Gar Wood excavators to help keep jobs on schedule. A 75B with trench hoe and a 75BT truck crane with clam-shell are currently speeding work for this firm on the Linden Housing Project in Brooklyn. President Frank Marino says, "We've been using these units every day since we bought them, and they're certainly the sturdiest, most dependable units we've ever used. No down-time, repairs or service problems at all!"

Marino's operators like Gar Wood "75's" for still another reason. "Our operators say that the Gar Wood units are the easiest machines to operate they've ever worked with," reports Marino. "They especially like the clutch system." Gar Wood instant power actuated drum clutches increase production by reducing operator fatigue.

Gar Wood excavators deliver this kind of low-cost, dependable production because they're designed and built by specialists in ¾ yard machines. Find out for yourself how this specialization can pay off in more profit on your next job. Call your Gar Wood dealer, or write to: Customer Service Dept., Gar Wood Industries, Inc., Wayne, Michigan.

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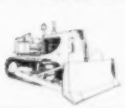
Plants in Wayne and Ypsilanti, Mich.; Findlay, Ohio; Mattoon, Ill.; Richmond, Calif.

Gar Wood-Buckeye Hi-Way Wideners


Gar Wood Tractor Equipment

Gar Wood-Buckeye Ditchers

Gar Wood-Buckeye Finegraders

Gar Wood Winches

Gar Wood-St. Paul Hoists & Bodies

. . . for more details circle 223, page 16

● McCammon-Wunderlich's asphalt plant near Palm Springs. From left: Power equipment shack, rock gates, Cedarapids crushers, conveyors, hoppers, and Standard Steel Corp. 6,000-lb. asphalt plant. Aggregates are separated into stock piles over 200-ft.-long tunnel. Conveyor in center foreground comes from tunnel entrance, feeding proper size into hopper, then to rotary dryer.

High Production Methods

(Continued from page 138)

nardino District of the California Division of Highways; C. V. Kane, district engineer, and V. C. Russell, resident engineer. George T. McCoy is state highway engineer. McCammon-Wunderlich's operations are under the general supervision of J. E. Beydler, general superintendent. The Miles & Sons Trucking Service subcontract is under field supervision by James Sherman, superintendent.

Low ground pressure tractor developed by Corps

A special low ground pressure tractor has been developed by the Corps of Engineers' Research and Development Laboratories, Fort Belvoir, Va., to tow "trains" of supplies and material over soft winter snow and summer muskeg in the Arctic. Fabricated essentially of parts from a conventional tractor, it has a unit ground pressure of only 3.4 psi, or almost 5 psi less than that of its standard equipment.

The 225 hp diesel tractor is equipped with an extended frame which provides a track 160 in. long on the ground. Track "shoes" are 54 in. wide.

Manufactured by the Peterson Tractor and Equipment Co. of San Leandro, Calif., the tractor utilizes standard controls, steering clutches and transmission. It also incorporates a torque converter with a manual locking device, and a cab which provides protection and comfort for the operator.

A smaller version of the tractor, powered by a 195 hp diesel engine has also been developed. Track shoes, 36 in. wide, are used to provide a unit ground pressure of 4.15 psi.

Both tractors towed sleds laden with heavy supplies during tests conducted by the U. S. Army Transportation Corps on the Greenland Ice Cap and at Houghton, Mich. Tests indicate that the tractors may provide the Armed Forces with a comparatively slow, but effective Arctic "locomotive."

Railroad vs. highway relationship discussed

The relationship of the highway program to the railroads was brought into focus recently with facts that will interest highway planners. U. S. News and World Report in an interview with James M. Symes, President of the Pennsylvania Railroad, gave some provocative comment on two aspects:

● A many-billion-dollar federal highway program, he feels, would help rather than hurt the railroads in the long run. An expected net increase of 20 million private automobiles and 3 million trucks between now and 1965 would mean 43 million more tons of steel, 2 million more tons of rubber and millions more tons of glass running on the highways, plus more aluminum and other products — all such raw materials requiring rail transportation. "It will be terrific," he commented.

Likewise the jump in the average per-family income to an expected $6,700 per year will create immense new consumer buying power. This growth in prosperity is anticipated in part because of the stimulation of better highways and the economic activity created by their construction.

● Mr. Symes also talked about hauling trucks on railway flatcars — a practice which threatens large losses in fuel taxes, ton-mile taxes, turnpike tolls and other highway revenue sources. Piggy-back hauling saves the trucker 2 to 4 cents per mile compared with hauling over the highways.

Mr. Symes ventured that because of the economics on certain runs the practice will grow. One typical trainload of trucks-on-flats brought 97 trucks into Chicago with a five-man crew, and also saved on terminal costs. The truck-on-flat-car hauls will be welcomed by the public because it will relieve congestion. Mr. Symes however also thinks that truck transportation will, and must, continue to grow on the highways because of our expanding economy.

Contractor's Equipment Worth More Than His Job

Grading Equipment

6 Caterpillar D8's
2 Caterpillar 80 scrapers
4 Caterpillar DW20's
4 Caterpillar DW21's
1 Marion 4-yd. dragline, Esco bucket
3 Southwest sheepsfoot roller sets
50,000 lin. ft. cast iron and aluminum pipe
2 Berkeley electric pumps

Subbase Course and Cement Treatment

6 Caterpillar 12 motor graders
10 Peterbilt 30-ton semis, bottom-dump
2 Cedarapids crushing-screening plants
1 PMCO cement bulker
2 Pettibone Wood Roadmixers
2 6,500-gal. water trans. DW10 units
2 4,000-gal. water trailers
1 Tampo self-propelled pneumatic roller
1 Buffalo-Springfield 3-axle tandem roller
1 Shop built spreader box

Paving

2 Barber-Greene finishers
2 Athey windrow loaders
2 Caterpillar 12 motor graders
1 Ingersoll-Rand air compressor
1 Littleford power broom
2 Galion steel tandem rollers
1 Buffalo-Springfield roller
2 Tampo self-propelled pneumatic rollers

No special lifting equipment needed. The machine that dug the trench for this job was also used as a hoist in laying the pipe.

Here's the Way to Lower Your Drainage Bids Without Cutting Profits

It's easy to get the jobs *and* the profits when you figure drainage bids with Armco Corrugated Metal Structures. You save time, labor and equipment costs.

For example, with long, 20-foot lengths of Armco Pipe you have fewer pieces to haul and handle, fewer joints to make. A small crew with no special tools can do a fast, efficient job. And inclement weather is no problem.

Armco Drainage Structures are corrugated for high strength with light weight. A rope sling or a small A-frame can be used to handle the largest structure with no danger of cracking or breaking.

It will pay you to investigate Armco Corrugated Metal Structures for your next drainage bid. Wherever you may be, there's always a nearby cooperative Armco representative to assist you—and a nearby fabricating plant to help assure on-schedule delivery.

Write us for more data. Armco Drainage & Metal Products, Inc., 5076 Curtis Street, Middletown, Ohio. Subsidiary of Armco Steel Corporation. In Canada: write Guelph, Ontario. Export: The Armco International Corporation.

Joints can be made quickly and easily. Here one man tightens the two bolts on a connecting band with a hand wrench.

Armco Drainage Structures

ARMCO

. . . for more details circle 185, page 16

ROAD LIFE UP

Why More Freeway Engineers Are Specifying SOIL-CEMENT BASE STABILIZATION

The cost of constructing and maintaining today's modern freeways must and can be kept down! They must be designed to take a heavy beating from traffic!

That's why more and more engineers are specifying soil-cement base stabilization. The result: tougher roads are being built and taxpayers' dollars are going farther.

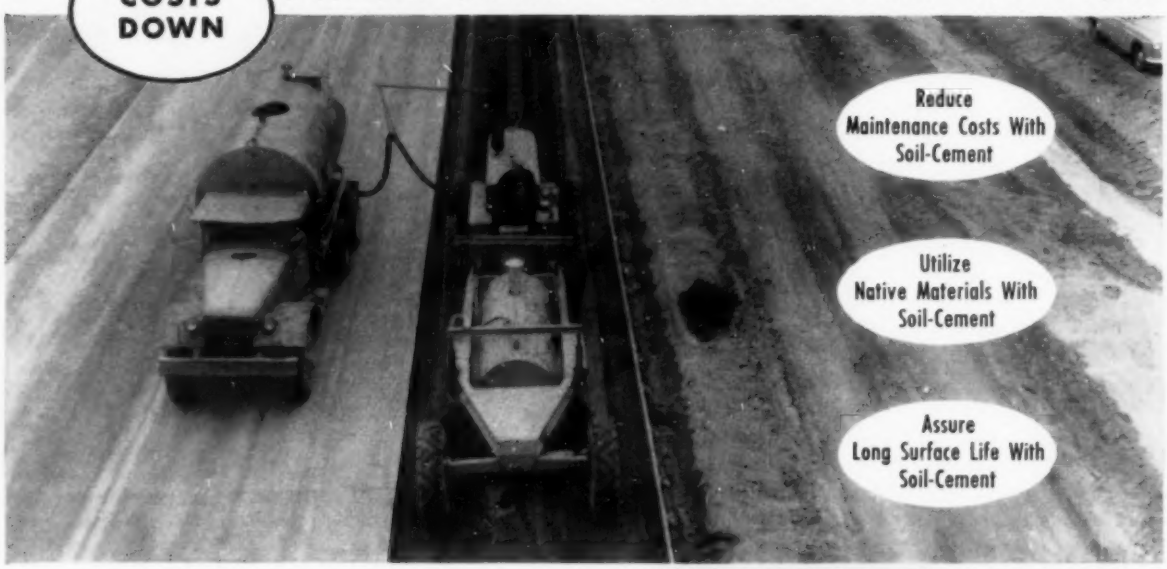
With soil-cement base stabilization, the base course can be made stronger—and often at a lower initial cost, since native minerals can be used.

Engineers are also looking to the future in their specifications. They know that soil-cement base stabilization will reduce normal maintenance and repair costs.

Let us send you case histories that demonstrate the advantages of specifying soil-cement base stabilization.

COSTS DOWN

Most Soil-Cement Is Mixed With Pettibone Wood Mixers


Reduce Maintenance Costs With Soil-Cement
Utilize Native Materials With Soil-Cement
Assure Long Surface Life With Soil-Cement

The Model 42 Pettibone Wood, Single-Pass, Self-Propelled Roadmixer, shown here in actual construction work on the freeway pictured above, produces 250 tons per hour of uniformly mixed windrows up to 6 cu. ft. ready for spreading. Tandem drive assures positive traction. Also available is the Single-Pass Model 54, which is tractor drawn and powered, with capacities up to 350 tons per hour.

PETTIBONE WOOD MFG. CO.

Subsidiary of PETTIBONE MULLIKEN CORP., Chicago
6900 Tujunga Avenue, North Hollywood, California
Telephone: STanley 7-3281

. . . for more details circle 318, page 16

Revised Paving Specs

(Continued from page 89)

showed a range from 81 to 115 percent with as much as 42 percent of the samples below the specified 95 percent. Techniques to achieve uniformity need greater attention, he concluded, going on to suggest that the principal element of control is moisture content. Where densities were low in the jobs investigated, it was found that moisture at such spots was also low.

Use of a motor grader to blend moisture and iron out ruts was strongly recommended by Felt. This precaution also helps to keep subbase within the narrow gradation band required. A subbase uniformly and highly compacted and having good control of fines will eliminate pumping. Uniform moisture and gradation must be obtained before compaction.

On the subject of joint pumping, Philip Fordyce of PCA's Highway and Municipal Bureau in Chicago, noted that there has sometimes been a failure to recognize the importance of keeping clay fines out of the subbase. On a job observed in a southern state, the joints began to pump soon after construction. The cause was traced to the passage of contractor equipment over the subbase in wet weather. Although the contractor re-bladed and repaired the layer before paving, the clay which dropped from the equipment was not removed.

Such clay spillage also occurs when subbase are used by detouring traffic. Other instances were cited where shale used for subbase degraded into clay, leading to pumping. The early studies made of the pumping phenomenon are still valid, said Fordyce, who observed that pumping, when it occurs, is always attributable to violation of one or more of the established rules of good construction.

The two-day Concrete Conference was rounded out by several other speakers, A. A. Anderson, PCA's Chief Highway Consultant, told of tests and procedures related to thin concrete resurfacing and patching. P. F. Rice, Technical Director, American Concrete Institute, Detroit, discussed advances in prestressed and precast concrete construction and other phases of bridge design, with discussion by E. S. Gleason of the Michigan state highway department bridge staff. T. J. Sharpensteen, County Engineer at Flint, John Oltz, of Wayne County highway department at Detroit, and W. F. McNally, contractor from Saginaw, described experience with the new traveling form type paver.

Think what

Flintseal* **saves you**

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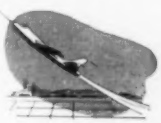

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. . . for more details circle 217, page 16

Harmonic Weather Cycles

By Halbert P. Gillette

IN THE May 1938 issue of the Bulletin of the American Meterological Society there was a 64-page symposium by American writers on "Climatic Variations" of a cyclic nature. The last paragraph of the present writer's article was: "It should not be surprising if the first thoroughly convincing evidence of the basic cause of climatic cycles is secured by studying geological cycles. If so, it probably will result from accurate determinations of their lengths by the aid of varves. Such determinations will, I believe, disclose a harmonic system of cycles, for already there is no inconsiderable evidence of cycles that are three times as long as other cycles, indicating a serial harmonic factor of three. The very name of the Triassic Period indicates such a relationship, not to mention the frequent subdivisions of other Periods into upper, middle and lower groups; and these in turn, frequently into upper, middle and lower subgroups."

In several of the writer's recent articles in ROADS AND STREETS (notably those of July 1954, July, November and December 1955), geological and other evidence of harmony of a series of four long climatic cycles was presented. The shortest of these is 672 years between rainfall maxima, and the lengths of the others are in a geometrical progression series whose ratio is three. It was stated that the longest of the four is 18,144 years, and that several more longer ones in this series exist, one being the Ice Age Cycle of 9 times the one of 18,144 years.

The variable thickness of treerings in Formosa (Fig. 1) beautifully discloses the 672-year cycle which the writer ascribes to a planet designated as Alpha, whose orbital period is 672 years.

It is very significant that the Baltic Sea has twice been frozen thick enough to support horses between Sweden and the opposite shore, namely in 1323 and 1658, or 335 years apart, or within one year of half of the 672 year climatic cycle. In the article of last November and December the writer discussed heliocentric (sun-centered) weather cycles caused by the giant planets Jupiter, Saturn, Uranus and Neptune with one another and with the inferred giant planet Alpha. The period of Uranus is just ⅛ that of Alpha, and they were in conjunction in 1658. The mean length of any heliocentric conjunction period of two planets is the product of their lengths divided by their difference, which is 96 years for Uranus and Alpha. Planets tend to cause abnormal rainfall near conjunction epochs, and less abnormal rainfall near their oppositions. There is a cycle of 48 years mean length caused by Uranus and Alpha. Such an opposition was due about 1322, and partly explains the freezing of the Baltic in 1323. Also Uranus caused abnormal rainfall in 1323, for 1658 — (4x84)=1322 A. D.

Tables 1 and 2 are reprinted from the article of last December. All the deduced cyclic lengths in Table 2 were confirmed by analyses of the thicknesses of treerings and lake varves (Lake Saki).

Table 1 shows that orbital periods of the planets are too nearly commensurable to be accidental. Moreover they are too nearly commensurable with the 22.4 and 11.2-year cycles in sunspot numbers to be accidental. The writer deduced the lengths of those major sunspot cycles by analyzing sequoia treerings back to about 1300 B. C. and Lake Saki varves back to about 2300 B. C.

Sir John Herschel (Esseys, p. 297) in 1848 called attention to the remarkably close approach to commensurable lengths of Saturn's first four satellites. It is so close that at that time he thought it was exact.

The article on Astronomy (p. 810) in the 9th and 10th editions of *Encyclopedia Britannica* states that: "A singular relation exists between the motions of Jupiter's three inner satellites. It will be observed from the table of elements that the period of the second is almost exactly double the period of the first, that of the third almost exactly double that of the second, in other words they are almost exactly as the numbers 4, 2 and 1." It should be added that the siderial period of the third satellite is about 7.154 days. H. H. Clayton and several other researchers have found a weather cycle of about 7 days; and Douglass found a rainfall cycle of about 28.5 days. George E. Hale located the sun's north magnetic pole by its spectroscopic effects, and found that its synodic period of rotation is about 31.8 days, equivalent to a siderial period of about 29.3 days. One quarter thereof is about 7.42 which is close enough to the 7.15 above given to indicate that this satellite may have been generated by the sun's magnetic cycle, which may also cause the 7.1-day rain cycle found by Defant. The Douglass rain cycle of about 28.5 days may be caused by rotation of the sun at its magnetic pole's; which may have generated our Moon, whose present siderial period is about 27.32 days. This will be discussed in a later article.

The writer has found a rainfall cycle of 27.32 days at Portland, Oregon, by an analysis that covers 200 repetitions; and another rainfall cycle of 29.52 days (the lunar month) by an analysis covering repetitions. The rain peak of the 27.32 day cycle occurs when the moon is in celestial longitude 270°, that is when direct-

Table 1 — Harmony of Original Orbital Periods

Planet	Present Period	Original Period		Difference Percent
Mercury	0.241	¼ X 1.0 =	0.250	4.0
Venus	0.615	1/36 X 22.4 =	0.622	1.2
Earth	1.000		1.000	0.0
Mars	1.881	1/12 X 22.4 =	1.867	0.8
Jupiter	11.862	½ X 22.4 =	11.200	5.9
Saturn	29.458	2½ X 11.2 =	28.000	5.2
Uranus	84.013	3 X 28.0 =	84.000	0.0
Neptune	164.793	2 X 84.0 =	168.000	1.9
Pluto	248.430	3 X 84.0 =	252.000	1.4
Alpha	672.000	8 X 84.0 =	672.000	0.0

ly south of the earth's equator. The peaks of the 29.53 day cycle occur at full moon. Peaks of these two lunar cycles will occur within a few hours of each other on June 23, 1956; and their resultant effects will be abnormally strong for such short cycles.

In his Solar Relations to Weather and Life, (Vol. 1, p. 56), H. H. Clayton gives a table of "Amplitudes of Harmonics of a 22.6-Year Period in Pressure." The 22.6 years is his estimate of the length of an outstanding cycle in sunspot numbers, which the present writer has found to be 22.4 years in thickness of treerings and lake varves. Using Clayton's harmonic factors and the basic cycle of 22.400 years, its harmonic subcycles have the following lengths.

Table 3,

Harmonic Weather Cycles

Harmonic Factor	Cycle Length Years
1	22.400
1/2	11.200
1/3	7.467
1/4	5.6
1/6	3.733
1/8	2.800
	Months
1/12	11.2
1/24	5.6
1/36	3.72

The writer has a list of weather cycle lengths found by many other researchers agreeing closely with each of the first 7 cycle lengths; and has himself found each of them. He believes that the basic cycle of 22.4 years is the period of axial rotation of the sun's core, and that it has north and south magnetic poles 180° apart, but not coincident with the axis of rotation of the core.

In the writer's article of December 1954 it was pointed out that if abnormally dense streams of solar ions are emitted in heliocentric longitude 290° it would explain why each planet tends to cause sunspot and rainfall maxima when in that longitude, e.g. the Earth on July 12. Evidence was also cited that minor solar ionostreams exist at 30° intervals, as indicated by a sunspot cycle of 1/12 year when the Earth crosses one of those streams. It should be added that lesser ionostreams exist at 10° intervals, as indicated by rain cycles of 1/36 the length of the orbital periods of planets.

Confirmatory evidence of such a system of solar ionostreams is seen in Table 3; for in this case the rotation of a magnetic core of the sun causes its pair of magnetic poles to produce abnormal electronic and magnetic effects when a magnetic pole is in the longitude of one of the 36 longitudes that are 10° apart. In the writer's article of November 1955 on the 672-year climatic cycle due to Alpha, it was stated that a weather and treering cycle of 1/12 of 672 or 56 years had been found by the writer. It should be added that a treering cycle of 55.5 years length had been reported by Edmund Schulman in an article on "Douglass on Climatic Cycles and Tree Growth" (Bull. Am. Met. Soc., May 1938). In "Climatic Cycles and Tree Growth" (1936) Vol. 3, p. 126, Douglass called its length 57 years.

The writer has found a weather and an earthquake cycle of 1/36 of 672 or 18 2/3 years. At least 22 researchers have reported a weather cycle of 18 to 19 years, the average of reported lengths being 18.65 years. The last wet peak of the 56 year cycle was in July 1938, which was also the peak of the harmonic cycle of ⅓ its length. Hence the next peak of the latter will be about the middle of March 1957. Strong effects of such a cycle usually exist for a period of about 20% of the cycle's length, half thereof before and half after the peak.

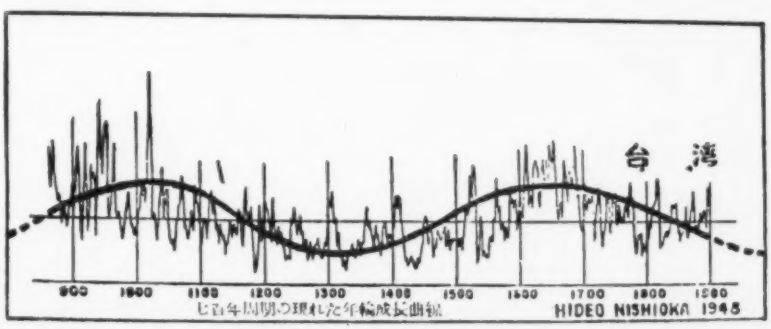
Table 2 — Rainfall Cycles Due to Heliocentric Conjunction of Giant Planets

	Cycle Years	Conjunction, A.D.
Jupiter — Saturn	19.859	1941.5
Jupiter — Uranus	13.808	1955.08
Jupiter — Neptune	12.789	1945.6
Jupiter — Alpha	12.074	1954.2
Saturn — Uranus	45.368	1842.6
Saturn — Neptune	35.871	1953.13
Saturn — Alpha	30.808	1944.3
Uranus — Neptune	171.33	1822.8
Uranus — Alpha	96.00	1946.5
Neptune — Alpha	218.35	1884.8

FOOTNOTE: Cycles in thickness of treerings often have maxima at opposition as well as conjunction of these giant planets. Alpha is an inferred giant planet of 672-year orbital period. The dates of its conjunctions are approximate, for its orbital eccentricity is not known; but they agree well by big treering analysis with the dates here given.

The 11.2-year cycle's length is exactly 1/5 of the 56-year cycle and their coincident peak in 1938 was marked by a very great sunspot peak in July. This is explained by the fact that the 12-month sunspot cycle had its maximum July 12 as an average of daily sunspot numbers for 50 years as shown in a table in the writer's article, December 1954. That peak was 57% higher than the valley January 10. The annual cycle caused by the Earth is harmonic not only with the 11.2 and 56-year cycles, but with the 84-year cycle caused by Uranus. Although the Uranus orbital period is now estimated to be 84.-01320 years, perturbations caused by unseen planets (e.g. Alpha) probably account for the estimated excess of 4.8 days longer than 84 years.

The 8.0-year cycle had a rain peak in 1938. Incidently at least 12 men have reported finding a weather cycle of about 8 years. The writer, as stated in his article of December 1955, regards this cycle as due to axial rotation of the core of Alpha. The very low density of each of the four visible giant planets is regarded by the writer as indicating that a core of about the density of the Earth is surrounded by a visible ionospheric



● Fig. 1. Graph of Formosa tree ring thickness by decades recording a 672-year rainfall cycle due to the inferred planet Alpha.

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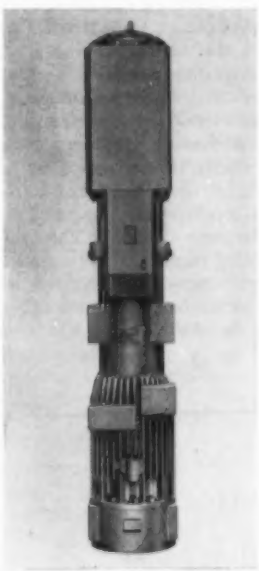

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shell. In the case of Jupiter, Uranus and Neptune if that shell has a diameter 1.5 times that of the solid core, it would explain the low overall density of the planet. In the case of Saturn, if the core's diameter is ½ that of the visible shell, it would account for the planet's overall density of only about 0.7 that of water.

The harmonic cycles in Table 3 indicate axial rotation of a dense molten core of the sun in 22.4 years. If its density is about that of the Earth (5.5), and the visible photosphere has a diameter 1.5 times that of the core, the overall density of the sun would be about that of Jupiter, Uranus and Neptune. More than a century ago attention was called by Sir William Herschell to this remarkable similarity of density of the sun and these three planets; and he posed the answer as an astronomical problem.

The sun has a series of ionospheric shells, one of which is probably the luminous photosphere. The next larger one is visible only during an eclipse, when it has a pearly light called the corona. Photographs of its circular periphery were jagged until Major A. W. Stevens photographed it from an airplane at great elevation during an eclipse, when the periphery was found to be a circle of just twice the diameter of the sun. The writer infers that it is an ionospheric shell that rotates axially and has a pair of magnetic poles like the sun's photosphere. Since the latter probably causes the above mentioned rainfall cycle of about 28.5 days discovered by Douglass, the coronal ionosphere may cause the "56-day" rainfall cycle that he discovered. The ratio of those two cycles is so nearly 1 to 2 that they may be harmonic.

Both the sun's photosphere and the coronal ionosphere emit radio waves, which shows their electronic nature. Recently evidence of two more solar ionospheres of greater diameter have been discovered by emitted radio waves of greater length. The lengths of these radio waves is a function of the diameters of these four ionospheres.

Several ionosphers exist within our atmosphere and each reflects artificial radio waves. Radio broadcasting, first effected across the Atlantic by Marconi in 1901 was made possible by such reflections. On Oct. 11, 1928, Jorgan Hals, a Norwegian civil engineer, heard radio signals echoed back after 15 seconds. The writer infers that it was echoed from a terrestrial ionosphere whose diameter is about 1,400,000 miles.

On May 8, 9 and 10, 1930, Galle and Tallon heard radio echoes nearly 30 seconds after the signal. It is significant that these three echo periods are very nearly commensurable; and that two of them have a ratio of 1 to 2, which is that of the sun's diameter to that of the coronal ionosphere.

In 1852 Kohlrausch detected terrestrial magnetic waves with a period of about 12 seconds, and in 1897 Eschenhagen's magnetometer disclosed that period of 30 seconds "was among the most common." These were caused by Nature's mechanisms, and the 30-second wave has the same length as that caused by a man-made instrument of the type that Hertz invented and Marconi developed.

The 3-second echoes of radio signals that Jorgan Hals was the first to hear came from a refector 280,000 miles away, or 40,000 miles beyond the mean distance of the moon. The writer infers that this radio wave reflector is an ionospheric shell in which the moon evolved, and that it is this ionosphere that causes the Zodiacal light. The Earth resembles the Sun in being surrounded by a series of ionosphers that probably rotate axially. Their rotation is probably caused by Faraday's principle of rotation of electric currents in a magnetic field.

A comet may be a series of rotating ionospheric shells encasing a small magnetic core of solid matter. Donatti's great comet of 1858 had two bright shells, whose diameter ratio was 2 to 1, as in the case of the terrestrial ionospheres that cause the 30 and 15 second radio echoes. The sun also has

two whose diameters have that ratio, namely the incandescent photosphere and pearly corona. Venus and Earth have nearly the same diameter. So do Uranus and Neptune, and it is very nearly four times that of Venus and Earth, a ratio not without significance.

Each of the four giant planets has a "family" of comets which at aphelion are close to the planet's orbit. This has been regarded as evidence of their "capture" by the giant planet; but it seems to the writer to indicate that the comets evolved partly in the solar ionospheres that beget the planets. The inferred plant Alpha, of 672-year orbital period, also has a family of 8 comets, as described in the writer's article of November 1955. From their aphelion distances Dr. C. H. Schulte deduced that they indicate a planet of about 678-year period. The writer has found that every known planet causes maximum rainfall when in heliocentric (sun-centered) longitude 290°, as an average of many revolutions. Hence Alpha's present longitude is about 88° if its orbital eccentricity is as slight as in the case of the four giant planets; and since it resembles them in causing cycles of notable amplitude in thickness of tree-rings and lake varves, it probably resembles them in other respects, e.g. in having an orbit of slight inclination to the ecliptic. If so, Alpha should be easily discovered. Its conjunctions with each of the four giant planets are given in Table 2, and serve to confirm its existence, as well as its slight eccentricity. Its last conjunction with Uranus was due about 1946. The annual mean of daily sunspot numbers was 156 in 1947, the greatest on record.

More cement to be available in corn belt

A reminder that cement production is primarily a localized matter, due to the haul limitations for this heavy, bulky commodity, comes from the Associated General Contractors of Minnesota, Inc. This association recently issued a bulletin to its members rounding up the progress being made to meet increased demands for portland cement in Minnesota and surrounding region.

Lehigh Portland Cement Company's plant at Mason City, Iowa, for example, is in the midst of a $12,000,000 expansion program. Together with the expanding production of other area cement producers, a total of 7,480,000 additional barrels of cement per year is assured by 1957. In Iowa, expansion programs are in progress also by Penn-Dixie, Hawkeye-Marquette, Dewey, Northwestern States, and Lehigh.

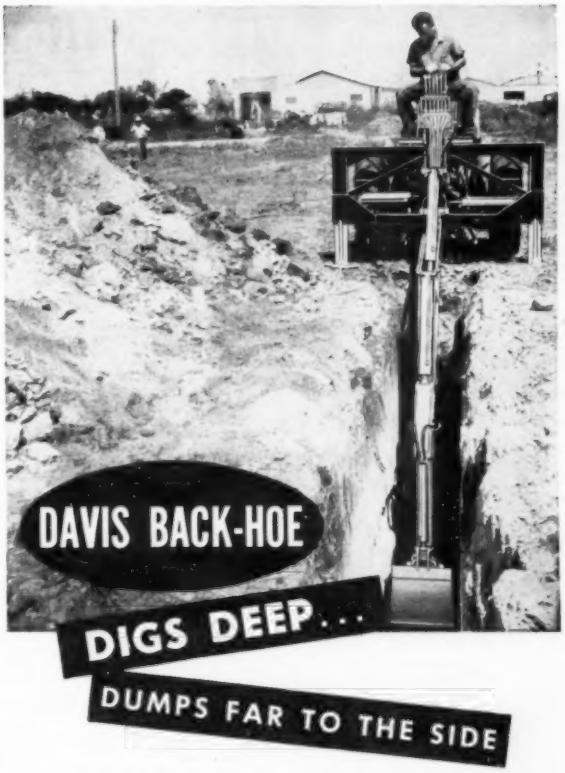
In Minnesota, the Universal Atlas Portland Cement Company has already put into operation a 280,000 barrel per year production increase and is expecting to add a new grinder plant in Milwaukee. In Milwaukee, the Hawkeye-Marquette firm is expanding and at Alpena, Michigan, the Huron Portland Cement Company, will step up production 3,000,000 barrels per year soon.

Cement utilization in Minnesota for all purposes in 1955 came to 5,837,000 barrels, an increase of 400,000 barrels over the previous year. Estimated consumption in 1956 within that state will exceed 6,000,000 barrels. The expansion of plant here noted will permit another 40% increase in Minnesota cement consumption, according to Minnesota AGC's bulletin to members.

Highway costs up 5% over a year ago

Road construction unit costs are running 5% ahead of 1955, comparing first quarter of the respective years. This was reported by the Bureau of Public Roads, which observed, however that costs are still 3% below 1955 average costs which were the highest highway costs in history.

The first quarter index was 132.4%, compared with the 100% base for 1946. Bid prices were made up in the proportion of common excavation 30%; pavement, 48%; reinforcing steel, 6%; structural steel, 3%; structural concrete, 13%.



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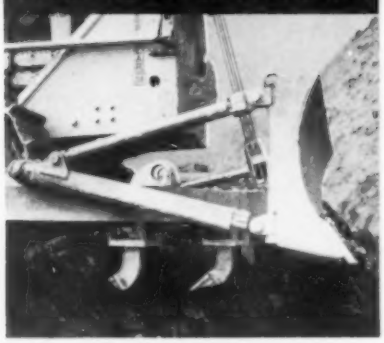

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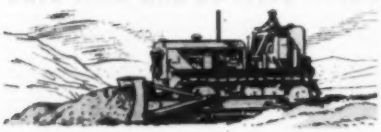

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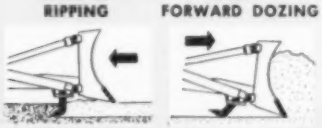

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III—Highway Estimating

(Continued from page 123)

pairs, fuel, lubricants, insurance including Workmans Compensation etc., and the wage of the operator. Some contractors use as the estimated cost of the unit of equipment, the going rental rate plus the operator and insurance — figuring that the equipment rental profit item which is included in the rental rate will help to pay for idle time between jobs. The cost of moving in and out should be included in the hourly equipment unit cost along with other items mentioned above. The procedure is common, whether the equipment of plant be stationary or mobile — as long as it is actually producing and is not used for service. Individual examples of such methods will be presented in later issues.

As pointed out in the first article in this series (April, 1956) the "Check or Reminder Lists" have long been in use by progressive contractors as a very useful tool for the estimator.

Familiarizing Yourself

The first move in estimating is to become thoroughly familiar with the bidding documents, specifications and addendums thereto, the contract form, and all general conditions. As this is being done it is common practice to make notes of such matters as will have to be considered in building up the estimated unit price. Good practice demands that even this routine chore be done systematically and with purpose — as opposed to jotting down notes on scraps of paper which may become lost or misplaced. It is just as easy to use a ruled form for this purpose and make it a part of the estimating record.

Taking the item of "Equipment" as an example, many bidding documents, specifications, etc., will clearly specify that certain type equipment be used. Should this have to do with the business of "compaction," the estimator checks this item off on the check list and under "notes," briefly sets down the specification requirements. Or, even though a certain type or piece of equipment is not specified, it becomes clear from the specification, that in order to meet the specification requirements, a certain type of equipment is necessary. This is checked off and notations made as before. It is quite possible that a piece of equipment now on hand may be adapted to the work, with or without alterations, so this also may be noted and later discussed.

Highway estimating must include a large number of broad classifications, for here we are covering a great deal of work other than the final paved surface — that for drainage, bridges large and small, culverts, open flumes, guards, cattle crossings, and in fact, a multitude of items falling into the category of heavy engineering construction. Many of these may be minor items but they still require equipment and tools of one nature or another to complete.

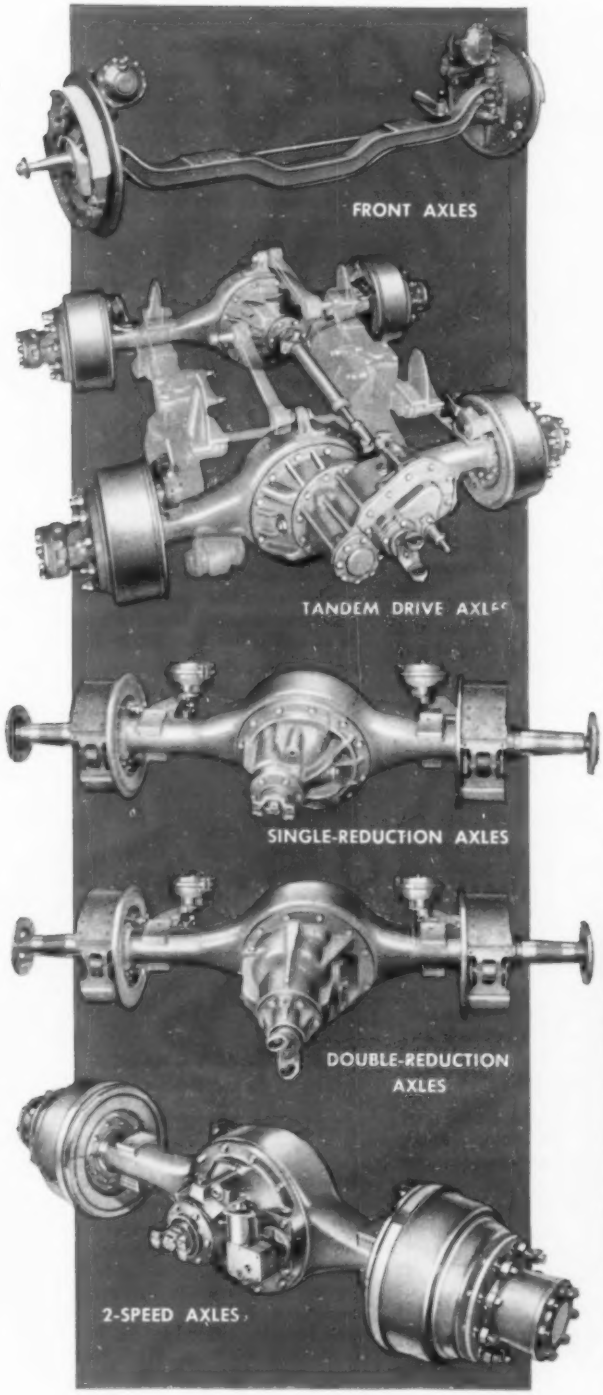
In the "reminder or check list" presented herein, occur nearly 500 separate and distinct pieces of equipment which may or may not be needed on the work being bid. Overlooking the provision of any of these may result in serious loss, for these are not "small tools" but generally characterized as "power operated equipment."

The estimator will find it quite simple, and certainly no added work, to check off needed items on the list as he makes his study of the bidding and contract documents, adding pertinent notes as he goes along. Then as the estimate is prepared, to see to it that this expense is provided for.

Final Selection of Equipment

It is understood of course that the final selection of equipment cannot be determined without first determining construction methods to be used, which at this preliminary estimating stage is not either practical or feasible. What is accomplished is an overall preliminary list of equipment requirements with the assurance that overlooking important expense items is held to a minimum.

A contractor of the author's acquaintance recently lost a nice contract because he overlooked that the State would supply certain equipment, the cost of which he had included in his bid. If he had made proper written note of this as suggested, it would not have slipped his mind in the haste of preparing his price.



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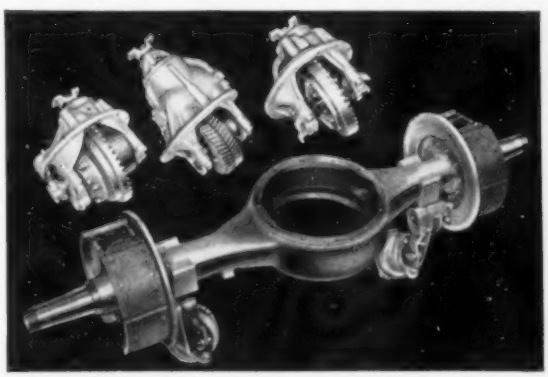

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PRODUCTS: Sodium Cooled, Poppet, and Free Valves • Tappets • Hydraulic Valve Lifters • Valve Seat Inserts • Jet Engine Parts • Rotor Pumps • Motor Truck Axles • Permanent Mold Gray Iron Castings • Heater-Defroster Units • Snap Rings Springtites • Spring Washers • Cold Drawn Steel • Stampings • Leaf and Coil Springs • Dynamatic Drives, Brakes, Dynamometers

. . . for more details circle 211, page 16

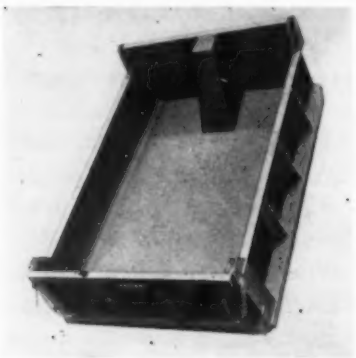
What's New
in Equipment and Materials

Reader Service Coupon on Page 16

Dump Bodies

A new line of contractor's type dump bodies, designed for use with Galion's Uni-scopic front mounted telescopic hoists to permit hauling of larger payloads within legal payload limits, has been announced by Galion Allsteel Body Co., Galion, O.

Known as the NF series, the new bodies are similar in design and construction to Galion's N series dump



Model 12N-3F Dump Body

bodies, with the addition of a compact well at the head end to accommodate the front mounted hoist cylinder. The hoist well, fitted with a removable access cover to facilitate cylinder inspection, is fully welded and reinforced to distribute lifting force throughout the body structure, the manufacturer says. Nominal side heights are increased 2 in. to maintain rated payload capacity.

Model 12N-3F bodies, with 3 in. channel crossmembers and 5 in. channel longitudinals, are available with payload capacities of 2 to 4 cu. yd. in lengths from 8 to 10 ft.

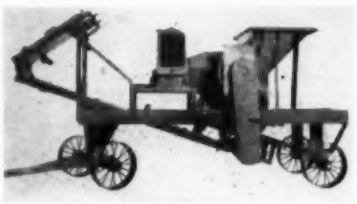
Payload capacities of 4 to 6 cu. yd. are offered in 9 and 10 ft. Model 12N-4F bodies. These feature 4 in. channel crossmembers and 5 in. channel longitudinals.

For more information circle 107 on Service Coupon Page 16 and mail now.

Small Portable Rock Crushing Plant

A small portable rock crushing plant, placed on the market by Pioneer Engineering Works, Inc., 1515 Central Ave., Minneapolis 13, Minn., subsidiary of Poor & Co., Chicago, is designed especially for smaller jobs for which the finished product need not be separated into various sizes or be within a specific gradation range.

Consisting of a truck-mounted jaw crusher and delivery conveyor, the No. 2 plant is complete in itself and can be easily moved intact.



Model No. 2
Portable Rock Crushing Plant

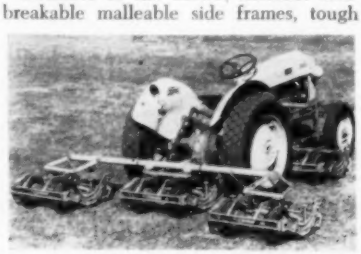
Rock or gravel can be fed to the large steel hopper on the jaw crusher by power shovel, truck or small dozer. The jaw crusher is of the overhead eccentric type, with feed opening 10x16 in., plain bearings, oil lubricated, and is easily adjusted while in motion to produce the size of material desired. The crusher can take rocks up to 8 in. in diameter, output varying from 4 to 40 tons per hour, depending on the type of material being crushed and the setting of the jaw.

For more information circle 108 on Service Coupon Page 16 and mail now.

Highway Tractor Mower

The new Highway Challenger, a heavy duty lift type 5-gang mower, announced by Roseman Mower Corporation, 2618 Ridge Road, Evanston, Ill., is especially designed for more efficient and safe mowing of turf areas bordering highways. The Highway Challenger is a large capacity 5-gang tractor mounted mower raised hydraulically for travel, for quick transit around abutments and obstructions, and for fast crossing of paved strips without endangering oncoming traffic.

Features of the mower include: nonbreakable malleable side frames, tough



The Highway Challenger

heavy duty reels of chrome nickel alloy steel, Timken bearings, a shock absorbing reel-knife design to prevent damage and laminated "No Air" tires that can not be punctured.

The flexible 5-gang design can be quickly reduced to a 3-gang mower by removing 2 pins, for mowing in congested areas. The mowers are available for models of 3 point hitch tractors.

For more information circle 109 on Service Coupon Page 16 and mail now.

Pocket Penetrometer for Soil Classification

A new pocket penetrometer for field and laboratory classification of cohesive types of soils has been introduced by Soiltest, Inc., 4711 West North Ave., Chicago 39, Ill.

The new direct reading penetrometer is claimed to greatly reduce the human element in classification of soils. It is a practical instrument for evaluating the shearing strength of soil in field exploration or on construction sites and in preliminary soil laboratory studies.

The penetrometer was developed on the basis of correlation studies which indicated that a very close relationship exists between the penetrometer readings and the soil type.

Technique of operation is extremely simple. The penetrometer piston is pushed into the soil up to the calibration groove. A pointer attached to the penetrometer's calibrated spring assembly indicates the reading in tons per square foot or kilograms per square centimeter unconfined compressive strength.

The complete penetrometer weighs only four ounces. It has a diameter of ¾ in. and is less than 7½ in. long.

Pocket Penetrometer

For more information circle 110 on Service Coupon Page 16 and mail now.

Tractors for Construction Equipment Attachments

Two new economy models of the Fordson Major diesel tractor, designed for use with equipment such as loaders, trenchers and diggers where hydraulic lift and implement linkages are not required, have been announced by the Tractor and Implement Division, Ford Motor Co., 2500 East Maple Road, Birmingham, Mich.

With the exception of the hydraulic system and linkages, the utility models have all of the features of the standard FMD 4-wheel tractors, including six forward and two reverse speeds, sealed beam headlights and taillight, adjustable swinging drawbar, 12-volt electric system and starter motor, oil bath air cleaner, transmission type power take-off, and 600-lb. wheel weights.

For more information circle 111 on Service Coupon Page 16 and mail now.

International Model 65 Payhauler

International Launches Broad New Construction Equipment Line

International Rear Dump Payhaulers

The two models of Payhaulers are the result of testing in the field on 44 different contracting, mine, quarry, and other field applications where the new Payhaulers will be used. Others have been subjected to "round-the-clock" testing at the International Harvester Co. proving grounds.

The overall dimensions of the 95 Payhauler equipped with standard body are as follows: The wheel-base is 13 ft. 9 in. Overall length is 26 ft. 1 in., overall width is 11 ft. 6 in., loading height is 9 ft. 2 in. Turning radius 30 ft. 5 in. Track, front 86 in.; rear 92⅝ in. Empty weight with quarry body equipped with torque converter 47,980 lb. With 9 speed transmission 46,610 lb. With a standard body equipped with torque converter transmission 48,220 lb., 9 speed transmission, 46,850 lb.

The Model 65 Payhauler has a wheelbase of 13 ft. 2 in. Overall length is 24 ft. 11 in. Overall height, 11 ft. Overall width, 10 ft. 8⅜ in., loading height 9 ft. Clearance under the front axle 15 in., clearance under drive axle 14⅝ in., turning radius 29 ft. 3 in., track, front 82⅜ in., rear 84¼ in. Empty weight with quarry body equipped with a five speed transmission 39,865 lb., 10 speed transmission 40,160.

The 24-ton Model 95, 16 yd. Payhauler is powered by a Cummins Turbo-charged diesel engine developing 335 hp at 2100 rpm. The 18-ton, Model 65, 12-yd. Payhauler is powered by a Cummins turbo-charged diesel engine developing 250 hp at 2100 rpm.

The Model 65, with either the 5 or 10 speed transmission, and air assisted master clutch, can roll along at 36½ miles per hour. The Model 95 has a top speed of 37.2 miles per hour, when equipped with a standard 9 transmission and a top speed of 38 miles per hour with a torque converter and power shift transmission.

The Payhauler bodies provide 4 different styles to meet all hauling duties. The Model 65 can be equipped with a quarry body; the Model 95 with a standard body, a quarry body, or an exhaust heated body.

Hydraulic double-action hoists raise the body quickly. The chute type body swings down behind and below the rear wheels dropping load completely over the edge or rim of hopper. Bodies are designed to shed the toughest materials. The dumping angle is 65 degrees. Lifting speed to maximum raised position in the Model 65 is 7.5 seconds and in the Model 95 is 9.1 seconds.

For more information circle 112 on Service Coupon Page 16 and mail now.

International Model 12 Payloader

The Model 12 Payloader is the result of a wealth of experience gained from producing and selling approximately 23,000 rubber-tired tractor shovels by the Frank G. Hough Co., a wholly owned subsidiary of International Harvester Co.

Highlights of the new unit are: (1) 91½ hp engine in rear; (2) better balance; (3) superior stability; (4) full power shift transmission and torque converter drive; (5) power boosted steering controls; (6) high break-out; (7) 40 degree bucket tip-back at ground level; (8) a unique super-service body tilt; (9) adjustable operator seat; (10) closed hydraulic system with pressure control; (11) hydraulic system accumulator; (12) 1¾ cu. yd. capacity; (13) 8 ft. 10 in. discharge height and (14) three forward speeds from 0 to 10.1 mph and three reverse speeds from 0 to 13.1 mph.

Power plant for the new International Model 12 Payloader is the balanced power International UD-350 diesel engine, which is rated at 91½ hp for this unit. With the engine mounted in the rear, it not only drives the unit but also serves as a counterweight. The general arrangement and weight distribution of the Model 12 is such that an optimum distribution through the full length of the track can be gained without a counterweight.

Controls, steering clutches, and steering brakes are power boosted. This feature alone decreases operator fatigue.

Immediately behind the engine is the torque converter, housed in the accessory drive case. It is single stage, two-phase with a multiplication factor of 2.1 to 1. The accessory drive case serves as a mounting base for: (1) main hydraulic pump; (2) torque converter; (3) transmission oil pressure regulating valve; (4) oil filter case for transmission and torque converter.

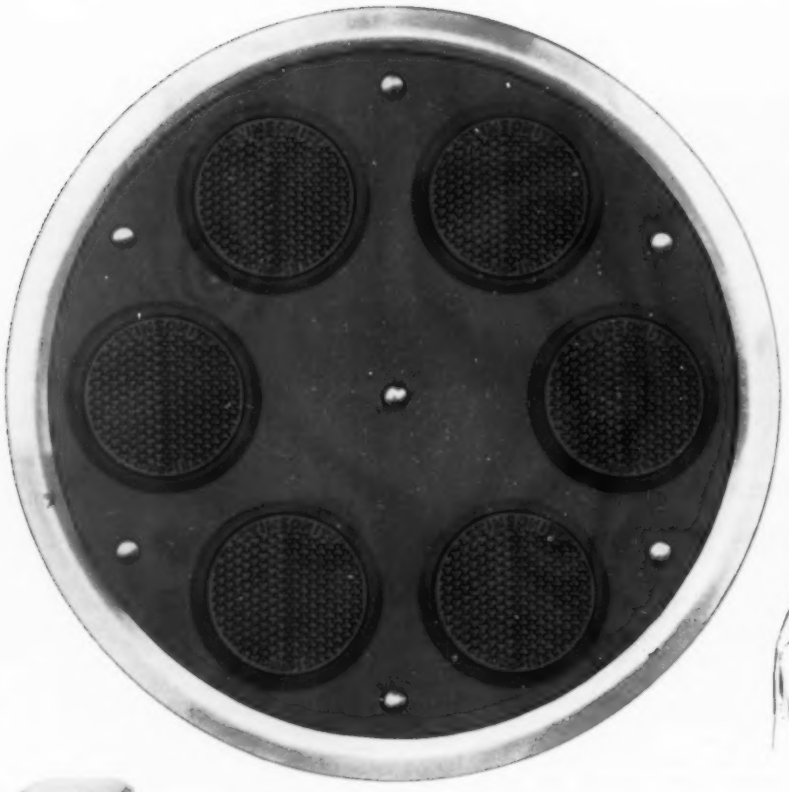
The next component in the power train is the transmission. It is a three-speed, full reversing, power shifted, constant mesh gear box. This transmission supplies three forward speeds ranging from 0 to 10.1 miles and three reverse speeds from 0 to 13.1 miles per hour.

The Model 12 Payloader is mounted on the fully proven TD-9 tractor with extended track frames equipped with 15 in. wide low profile grouser shoes. The track frame suspension arrangement is unique and is stated to provide the most rigid and substantial unit in the industry.

The hydraulic system of the Model 12 Payloader has the benefit and experience gained from the manufacture of

(Continued on page 158)

International Model 12 Payloader



15 inch cluster of six 3 inch Stimsonite reflectors.

make your traffic markers on the spot

with adaptable

STIMSONITE

reflectors

Have highway warning signals always available to meet the changing needs of a construction project or for regular maintenance operations. A few handfuls of sealed Stimsonite reflectors in metal holders, plus a small stock of reflectorized arrows and cutout letters, and it's simple to make an almost unlimited choice of traffic markers on the spot, to fit the job.

Stimsonite gives you the most brilliant warning signal and the greatest durability of all reflective materials. The smooth curved surface of a sealed Stimsonite reflector washes clean. No dust or moisture can penetrate and the molded-in deep colors can't possibly fade. Simply attached by the use of wood screws through the housing, these reflectors can be removed and re-used time and again. Just a few types of metal housed Stimsonite reflectors are shown above. For full details, get in touch with A'G'A Division of Elastic Stop Nut Corporation of America, 1027 Newark Avenue, Elizabeth 3, New Jersey.

STIMSONITE® *for* — *Seeability* / *Readability* / *Durability*

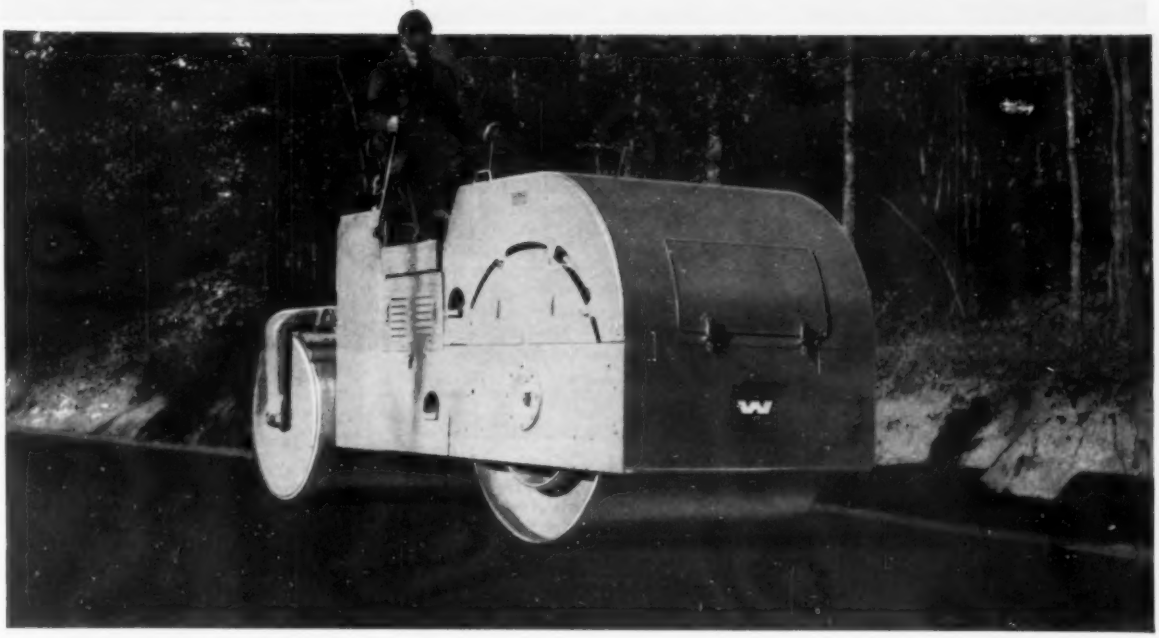
AGA DIVISION

ELASTIC STOP NUT CORPORATION OF AMERICA

1027 NEWARK AVENUE, ELIZABETH 3, NEW JERSEY

. . . for more details circle 317, page 16

NOW HUBER-WARCO TANDEMS OFFER torque converter 2-speed transmission



Two new important features added to Huber-Warco medium and large sized tandem rollers are: a torque converter and a two-speed transmission.

The torque converter offers all of the advantages of a fluid coupling, with these important plus features: (a) available power is doubled, (b) the roller maintains approximate rolling speed regardless of grades encountered, and (c) fuel consumption is reduced.

Advantages of the two-speed transmission are: (a) at slow rolling speeds, the use of low gear maintains sufficient RPMs at tailshaft to keep governor effective, (b) makes correct gear ratio available to meet any work load or desired rolling speed, thus reducing strain on converter and engine, and (c) allows the engine to maintain sufficient RPMs to provide hydraulic pressure for fast steering at low rolling speeds.

Other important Huber-Warco features include: the exclusive guide roll assembly that will not "scuff" (factory perfect adjustment for the life of the roller); full hydraulic steering with variable speed adjustment; two braking systems; dual controls; close curb clearance and many other features that make the Huber-Warco tandem line outstanding.

Huber-Warco medium and large sized tandems are gasoline and diesel powered and are available in 5-8, 8-10, 8-12 and 10-14 ton models. A 3-5 ton tandem with water cooled engine and torque converter as standard equipment, is also available.

Write for specifications.

For a demonstration — see your nearest Huber-Warco distributor

HUBER W WARCO

HUBER-WARCO COMPANY

MARION, OHIO, U. S. A.

Road Machinery

CABLE ADDRESS: HUBARCO

ROAD ROLLERS • MOTOR GRADERS • MAINTAINERS • GRINDERS

. . . for more details circle 239, page 16

25,000 rubber-tired loaders. The hydraulic circuit originates in the closed type, pressure controlled reservoir, which is located above the pump so gravity prevents pump cavitation. A hand hole has been provided for periodic cleaning and a convenient dip stick on the filler cap assures proper level maintenance. The gear type, two-element pump receives oil from the reservoir at zero pressure and converts it to high-pressure oil. The larger element of the pump furnishes slightly over 50 gpm for operating the boom and bucket controls. The smaller element furnishes approximately 10 gpm and is used only for the steering clutch and brake control. The boom is raised or lowered by two 7 in. diameter double-acting cylinders. The bucket is operated by two 4 in. diameter double-acting cylinders. All four piston rods are chrome-plated.

A showing of International Harvester Company's complete line of construction equipment was staged in May at the company's Dundee, Ill., proving ground. The demonstration climaxed a two-day press party designed to illustrate International's growth in the construction equipment industry in the past five years. Five years ago International built only crawler tractors, power units, and engines for use in other makes of equipment.

International now produces 7 models of crawler tractors, 18 power units, three sizes of 4-wheel scrapers, two self-propelled scrapers, two new off-highway trucks, a self-propelled, bottom-dump wagon, five International Drott Skid Shovels, and the new rear-engine Payloader.

In addition, the Frank G. Hough Co., a wholly-owned subsidiary, produces six rubber-tired, rear-engine, front end loaders.

International also manufacturers 228 different attachments to be used with its equipment, including upwards of 42 new Bulldozers, and Bullgraders.

An important feature of the demonstration was the introduction of International's new Model 12 Payloader, believed to incorporate the most advanced features of any crawler-tractor loader on the market today, and the completely new International 18 and 24-ton Payhaulers, off-highway, rear-dump trucks.

For more information circle 113 on Service Coupon Page 16 and mail now.

Asphalt and Aggregate Spreader

An improved towed asphalt and aggregates spreader has been announced by Miller Spreader Corporation, 4020 Simon Road, Youngstown, O. The basic design of the Miller spreader has been retained, but several exclusive, new features, increased durability and many labor-saving accessories have been added.

The new unit features a standard floating screed mechanism which moves forward on an even plane no matter how irregular the base surface may be. This is stated to permit laying of a smooth, level strip ready for rolling. The floating screed is fabricated from ¼ in. steel

New Miller Towed Spreader

plate, and has been an exclusive feature on the Miller spreader since the product was first introduced. An important addition to the floating screed has been made on the new spreader unit. A crown device is now built into the screed, permitting crowns and reverse crowns up to 2½ in. thickness. Accurate crowning adjustments can be made immediately by means of a torque-screw located at the center of the crown-bar. With this one simple innovation it is stated contractors can now easily spread level, concave or convex surfaces.

To eliminate damage or crimping of hopper edges, Miller now equips the forward edge of its spreader with a heavy rubber apron which also serves to prevent loss of material by spilling.

For more information circle 114 on Service Coupon Page 16 and mail now.

Concrete Saw

A new Eveready concrete saw designed for production sawing on airfield installations, super highways and turnpikes, has been announced by the Eveready Briksaw Co., 1509 South Michigan Blvd., Chicago 5, Ill.

Model E-36 PD is equipped with a 36 H.P. 4-cylinder, air cooled engine

Model E-36 PD Concrete Saw

that drives the saw under full load at speeds up to 25 ft. a minute. Two abrasive coated drive wheels in direct contact with solid rubber tires give positive traction under all kinds of operating conditions. This rear wheel drive eliminates slipping, sliding, jerking, bumping or twisting the blade. The saw moves forward smoothly, continuously.

"Powr-Drive" is the name for Eveready's self-propelling unit and it is engaged or disengaged by foot pedals within easy reach of the operator. Cutting speed is quickly set by turning the control lever on the variable speed transmission.

Another outstanding and new feature of the E-36 PD is "Tip-N-Turn" that allows for instant maneuvering. The saw is merely tipped and then turned in much the same manner as a wheelbarrow is turned. This easy maneuverability is accomplished through the new design of the saw that places the motor ahead of the front wheels. This proper weight distribution also keeps the blade in the cut on hardest aggregates even when the saw is operating at top speeds.

For more information circle 115 on Service Coupon Page 16 and mail now.

New Line, GMC Trucks

An improved and expanded line of heavy-duty trucks designed to give peak performance in both highway hauling and off-the-road operation was announced May 1 by GMC Truck and Coach Division, General Motors Corporation, Pontiac, Mich. The heavy-duty

GMC Model DW630 Diesel-Powered, Tandem Axle Dump Truck

GMCs for 1956 include an expanded line of versatile tandem-axle models, a wide range of four-wheel vehicles with more powerful gasoline and diesel engines, and many engineering advances to give greater vehicle durability and performance.

The heavy-duty line ranges from four-wheel gasoline models with 22,000 lb. gross vehicle weight to tandem-axle vehicles with 90,000 lb. gross combination weight.

Several entirely new models, including an FW550 dual-purpose, tandem-axle tractor and a tandem-axle W670, are offered.

The FW550 has a front axle rated at 14,000 lb. and a 34,000 lb. rear axle, a 5-speed syncro-mesh transmission, 210 hp, V-8 engine, and power steering.

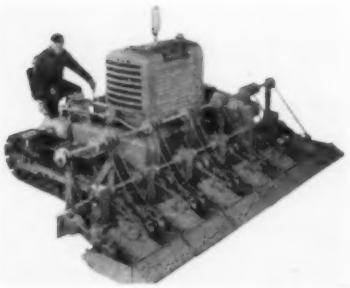
With a 59,000 lb. GVW and 90,000 GCW, the W670 offers a choice of an 11,000 or 14,000 lb. front axle and a 48,000 or 50,000 lb. rear axle, and has as standard equipment a 5-speed main and 3-speed auxiliary transmission, a 225 hp gasoline engine, and double channel frames.

Six and 8-cylinder gasoline engines ranging from 160 to 225 hp and diesels from 150 to 230 hp are offered in various models.

For more information circle 116 on Service Coupon Page 16 and mail now.

Vibro-Tamper Compaction Efficiency Increased

A 17.5% increase of weight of eccentric rotors in the redesigned compaction shoes of the self-propelled VT 6-4 Vibro-Tamper of The International Vibration Co., 16702 Waterloo Road, Cleveland 10, O., is reported to add over 8% ef-



VT 6-4 Vibro-Tamper

ficiency in the single-lift compaction of sub-base and base courses in highway and runway construction. To properly apply the increased force, the machine has been equipped with a new 75 hp industrial engine that provides more torque under full load.

The Vibro-Tamper achieves its high compaction efficiency by means of six shoes equipped with eccentric rotors in opposition, V-belt driven from a common floating power shaft. With the added rotor weight, each shoe is stated to provide a dynamic compaction force of over 8,640 lb. at 2,200 vibrations per minute.

The efficiency gained with the 80-lb. rotors is said to enable the machine to compact single lifts of sand, gravel and other granular materials of up to 12 in. in only two passes at a rate of 20 to 38 fpm obtaining as high as 95 to 103 standard modified Proctor density. The machine also is stated to handle single lifts of stone of up to 14 in. with the same efficiency.

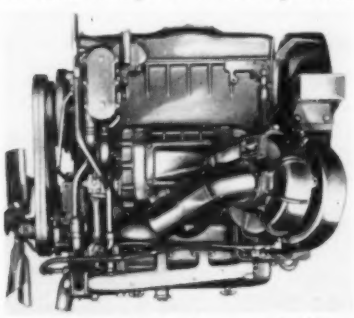
For more information circle 117 on Service Coupon Page 16 and mail now.

Three Turbopower Engines

Three turbopower engines as additions to its Series 71 line of industrial 2-cycle diesels, have been announced by Detroit Diesel Engine Division of General Motors, Detroit 28, Mich. Presently available are 4 and 6 cylinder fan-to-flywheel engines and a 6-cylinder base-mounted power take-off unit.

Retained in the new models are all the features of the already highly efficient Series 71 engine. With the addition of a single-shaft, exhaust-driven turbine and air impeller, a more powerful diesel of even greater fuel economy has been produced.

The 4-cylinder engine has a rating of 171 basic horsepower at 2300 rpm. The "Six" is rated at 236 basic horsepower at 21,000 rpm. Because of their compact size in relation to horsepower and their better fuel economy, these very flexible basic engines are also claimed to be ideally suited for use as replacement power in on- and off-the-highway trucks. Both fan-to-flywheel engines weigh approximately 9½ lb. per horsepower.



Four-Cylinder Turbopower Engine Has Rating of 171 Basic Horsepower

In the new units increased horsepower and better all-around efficiency at all engine loads is attained through improved combustion with no increase in fuel input. An exhaust-driven turbine and air impeller team up with the engine-driven blower to increase the scavenging air supply and the pressure at which it is delivered to the cylinders. This results in higher air-to-fuel ratios which in turn contribute to increased horsepower and better fuel economy. Horsepower is further increased since the air impeller supplementing the air supply to the cylinders helps reduce the amount of horsepower required to operate the engine-driven blower. The resultant saving in power is released for use at the flywheel.

For more information circle 118 on Service Coupon Page 16 and mail now.

New Crawler Model of Gradall

New Crawler Model of Gradall

A new and compact looking crawler model of the multi-purpose Gradall has just been announced by the Warner & Swasey Co., Cleveland, O.

The crawler mount has been redesigned in this model for more power with two speeds available at full power both forward and backward. Simplified controls actuated with one lever regulate the speeds of the crawler which has a 44 hp engine.

A selection of tracks ranging from 18 in. through 24 in., 30 in. to 48 in., make it possible to mount this gradall model on tracks with as low as 3½ lb. per square inch in bearing pressure.

The low speed with full power makes the new Gradall crawler model easy to operate on steeper grades than earlier Gradall models.

For more information circle 119 on Service Coupon Page 16 and mail now.

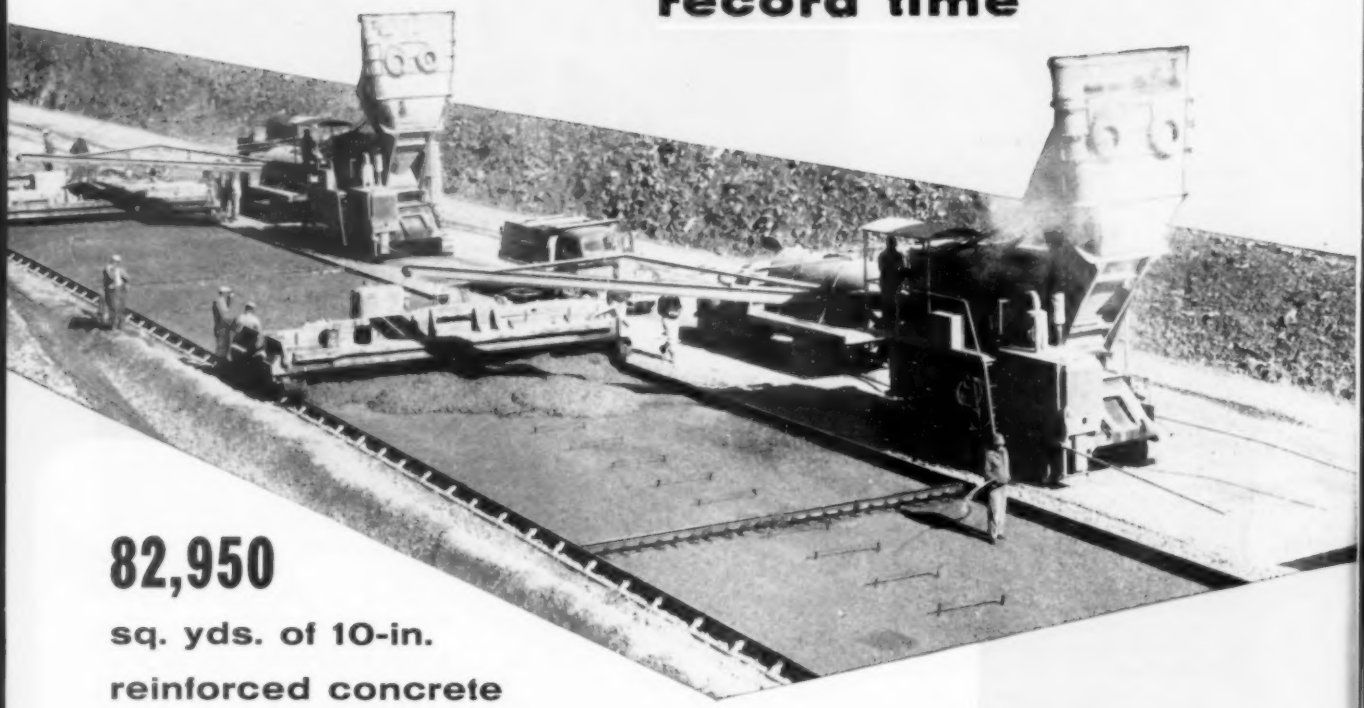
Mathematical Charts Speed Calculations

Two new mathematical charts, developed by E. J. George, Sun Oil Company, engineered and distributed exclusively by Frederick Post Co., 3666 N. Avondale Ave., Chicago 18, Ill., under the name "Calculine," provide a convenient, economical tool that can be used for the same purpose as a slide rule or calculating machine.

The charts, furnished on heavy 8½x11 cardstock, consist of a log scale superimposed diagonally upon a log grid. The Multiphase mathematical chart includes scales for multiplication and division as well as those for obtaining directly the square root, cube root, and logarithm of a number. The multiplication and division chart has the same pattern, but without the log, square and cube root curves. Both Calculine charts contain examples illustrating the various mathematical operations which can be performed.

For more information circle 120 on Service Coupon Page 16 and mail now.

BLAW-KNOX Paving Equipment knocks out yardage in record time



82,950

sq. yds. of 10-in. reinforced concrete poured in 23 ten-hour working days

● This is the record Williams Paving Company made on the northeastern extension of the Pennsylvania Turnpike System. Williams set this record by paving in 24-ft. widths. Average pour was 3,606.78 sq. yds. per 10-hour day and the top day was 4,533 sq. yds. or 1,700 lineal feet of 24-foot pavement put down. Key to this high speed operation was Blaw-Knox paving equipment which included two MultiFoote Pavers, Spreaders and Road Forms.

You will set profitable records on your single- or dual-lane paving jobs, too, when you use Blaw-Knox "Complete Package" paving equipment. From subgrade to finished pavement, this equipment is designed for high speed coordinated work. More and more contractors all over the country are taking advantage of one-source, one-responsibility economies of Blaw-Knox "Complete Package" paving equipment and methods.

THE BLAW-KNOX
"Complete Package"

Cement Batching Plant • Aggregate Batching Plant • Precision Subgrader • Self-Aligning Steel Paving Forms • Curb and Gutter Forms • Base Paver • Road Widener • Trench Roller • MultiFoote Paver • Concrete Spreader • Concrete Finishing Machine • Clamshell Buckets • Concrete Buckets • Hi-Boy Trukmixers • Ready Mix Batching Plant

50th Anniversary
BLAW-KNOX
1906-1956

44 CHARLESTON AVENUE

BLAW-KNOX COMPANY, Mattoon, Illinois

Construction Equipment Division

. . . for more details circle 192, page 16

Low-cost general construction hauling of stone, earth or asphalt is provided by the Mack B42S powered by the Mack Magnadyne engine.

"equal to any task"

Says Mr. Charles H. Ready, president of Ready Paving & Construction Co., Chicago, about his Macks . . . and with plenty of experience to back it up.

Back in 1920, the Ready management bought its first Mack to replace horse-drawn wagons. This chain-driven unit was retired only two years ago, after rolling up more than a million miles of heavy-duty construction hauling.

Today, the Ready fleet contains 18 Macks, including seven new B42S dumpers. These six-wheelers regularly haul 15 tons of stone or asphalt, or 15 yards of earth, both on- and off-highway. Their Balanced Bogies with exclusive Mack Power Dividers enable them to work in mud and on rough terrain where other makes can't operate. Famous Mack Magnadyne engines furnish plenty of power to keep these heavy haulers on the move with the barest minimum of time-out for maintenance and overhaul.

Here's how Mr. Ready sums up their 36 years' experience: "Our Macks have been found to be rugged and economical, always dependable, and equal to any task."

That verdict on Macks is practically unanimous throughout the entire construction industry. Whatever you want to haul, wherever you want to haul it, Macks are built to get the job done on schedule, at the lowest cost per mile. Mack Trucks, Empire State Building, New York 1, N. Y. In Canada: Mack Trucks of Canada, Ltd.

MACK
first name for
TRUCKS

4010

for more details circle 263, page 16

CHICAGO
the most IMPORTANT PLACE for the Construction Industry in 1957

A.R.B.A. ROAD SHOW and CONVENTION,

International Amphitheatre, Jan. 28 to Feb. 2, 1957

Here in Chicago everything is being done to make the coming A.R.B.A. Road Show and Convention an event that will be remembered for its value as an instructive conference, a helpful equipment show and its pleasures. Chicago's vast hotel setup is being organized to care for the large attendance that will be present. The International Amphitheatre is the largest exhibit hall in the Country and will provide an ideal spot for gathering and viewing the over 1,000 pieces of equipment that will be shown.

The Stock Yards Inn with its many eating places and cocktail lounges, and the cafeterias in the Amphitheatre, assure comfortable restaurant facilities.

Free Bus Service from the main hotels will assure adequate transportation and permit attending convention sessions regularly and at the same time allow you to spend time at the show.

Add to all this the many attractions that Chicago always provides.

Remember the place—the date—and make your plans. Ask to be put on the list to receive future information on the 1957 Road Show and Convention.

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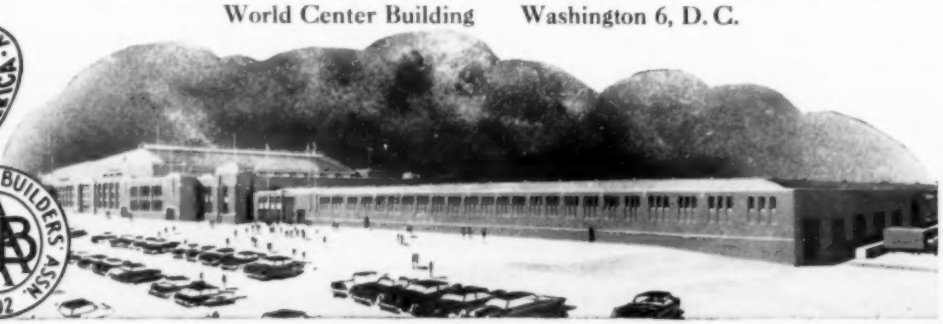

. . . for more details circle 183, page 16

Concrete Saws Have Direct Chain Drive

New 36 and 25 hp self-propelled concrete saws, introduced by Champion Manufacturing Co., 2028 Washington Ave., St. Louis, Mo., feature direct chain drive which is claimed to eliminate all slippage and to maintain constant torque. Powered by Wisconsin engines, the new saws have an automotive type muffler for more quiet operation.

New Champion Concrete Saws

A new type of clutch (patent pending) permits the direct chain driven rear wheels to operate independently when disengaged. Purchasers have their choice of hydraulic or screw feed to raise or lower the blade. Other features include an easily removable unit mandrel, dual 14 or 18 in. blade guards, hinged blade guard visors for curb cutting and a variable speed self-propelling unit. All controls on the units can be regulated from the operators position at the dashboard. Extended handle bars aid maneuverability and spotlights permit night operation.

For more information circle 121 on Service Coupon Page 16 and mail now.

Front End Loader Has 4-Wheel Steering

Four-wheel steering, two axle oscillation and unimpaired operator visibility are exclusive features claimed for the new model LD5T Scoopmobile of Mixermobile Manufacturers, Inc., Portland 20, Ore.

The model is a 1 cu. yd., 5000 lb. capacity front end loader, and is stated it will transport a full load with the bucket raised off the ground merely enough to clear the terrain.

Four-wheel steering is stated to afford the operator the ability to get around better in tight spots and rough terrain.

Two-wheel oscillation permits one wheel to drop into a hole in rough terrain without loss of tractive power to that wheel.

Standard equipment on the LD5T is torque converter, planetary drive, power steering, reversing transmission, two-axle oscillation, four wheel drive, four wheel steering and four wheel brakes.

Model LD5T Scoopmobile

For more information circle 122 on Service Coupon Page 16 and mail now.

1-day seismic survey solves subsurface problem for recreation center

Plans for the 10-acre Hayden Recreation Center in Lexington, Mass., call for a playground, main building and other structures. This is a glacial till area where bedrock varies widely and boulders are common. Exploration of the site by borings alone would have been difficult, expensive and time consuming. Stone & Webster, engineers for the site exploration, called in a Gahagan Seismic Survey Crew. They started work at 9 A.M. using portable equipment, and by 4:30 that afternoon, under ideal conditions, had completed 14 profiles of bedrock elevation each 110 feet long. Final report was submitted at 2:30 the next afternoon. Later, five test borings were put down at key construction points indicated by Gahagan's findings. Correlation between borings and seismic data was good. Stone & Webster report "results of seismic survey are most satisfactory." Write for factual Bulletin No. 3 to Geophysical Survey Division, Gahagan Dredging Corp., 90 Broad St., New York 4, N.Y.

Established in 1898, Gahagan is a leader in hydraulic dredging

ANOTHER
GAHAGAN
CASE HISTORY

. . . for more details circle 220, page 16

WHY Hand-Stitched Leather Covers Give EXTRA LONG WEAR

- CLOSER STITCHING HOLDS TIGHTER
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The everlasting choice in long steel tapes! Handsome, top-quality, leather case is hand-stitched over rust-resisting metal liner. Hand-stitching ensures a better, longer wearing outside cover. Exclusive Chrome Clad line is rust and corrosion resistant — will not chip, crack or peel. Bold black markings can't wear off. 25-50-75-100 foot lengths.

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PRECISION TOOLS
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THE LUFKIN RULE COMPANY
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400 BETTER MEASURE WITH LUFKIN

. . . for more details circle 260, page 16

WE OWN AND OFFER
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ELECTRIC WELDED STEEL REINFORCING WIRE MESH

Specs: 3" Sq. Mesh—5 Ga. Wire
In Rolls about 87" wide x 77 ft. long

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Approx. 420 Tons Available
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PRICE:

$160.00 Net Ton—Min. Order 100 Tons
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. . . for more details circle 320, page 16

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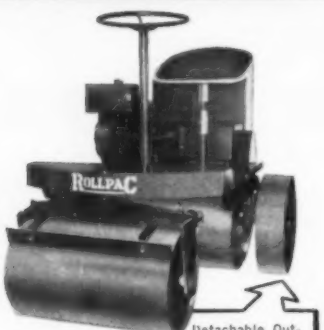

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$895.00

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Sold by over 95 distributors in United States and Canada
. . . for more details circle 278, page 16

Personals

Gen. Prentiss to ARBA

General Prentiss, who succeeded General Eugene Reybold (USA Ret.), has a background of over 35 years of distinguished military service. He is a graduate engineer of the Colorado School of Mines and entered the army as a Second Lieutenant, Field Artillery, in 1921. After regular army service he transferred to the Corps of Engineers in 1929 and has held increasingly important posts in the Corps.

The General became best-known, perhaps, after his appointment by President Truman, in December, 1952, as Engineer-Commissioner of the District of Columbia. He served during 1953 and 1954 in that capacity and was a popular administrative figure in Washington, D. C. He was promoted to Major General by President Eisenhower in 1954. In December of that year he took over command of the Engineer Center at Ft. Belvoir, Va., and served in that post until his recent army retirement.

● Maj. Gen. Louis W. Prentiss (USA Ret.) who became Executive Vice President of the American Road Builders' Association, Washington, D. C.

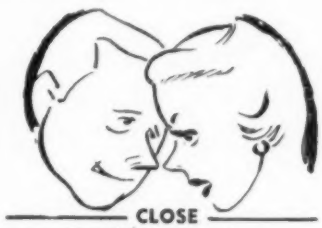
JOHN J. WHITE, principal associate and chief specifications engineer of Parsons, Brinckerhoff, Hall and MacDonald, 51 Broadway, New York, has been named a 1956 recipient of the New York University Alumni Meritorious Service Award. The award, given annually "to honor one who through good deeds has served Alma Mater," is the highest honor bestowed upon graduates by the University's Alumni Federation.

HARRY E. PAULET, formerly with Mutual Service Insurance Company, Inc., has joined the Associated General Contractors of Minnesota (AGC) as administrative assistant principally concerned with labor relations.

W. VAN BUCK, division engineer at Kansas City for the Bureau of Public Roads and the former state highway engineer for Kansas, has received an award of outstanding merit from the Department of Commerce, highest award given by the Commerce Department.

JOHN BUTTERS, chief engineer, Iowa Highway Department, is the 1956 president of The Mississippi Valley Conference of State Highway officials. George M. Foster, chief deputy commissioner, Michigan State Highway Department, is secretary-treasurer of this Association.

(Continued on page 166)



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Excellent facilities for Conventions and Special Events.

Garage open 'round the clock.

Room Rates from $4

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Cleveland's Most Interesting Hotel
Superior Avenue and
East Sixth Street
ROBERT P. JOYCE
General Manager

A Cat D315 Engine powers this ditcher working on a Houston residential development. Other Caterpillar equipment on this job includes six D8s, one D7, one D6 and two Scrapers.

Standardizing on rugged yellow equipment pays off two ways: (1) Big production at low cost and (2) fast, capable "one-stop" service from your Caterpillar Dealer.

WORKING IN TOUGH TEXAS GUMBO

F & C Equipment Co., Inc., Houston, specified a CAT* D315 Engine for this ditcher. Result: profitable production.

Digging a sewer line in Sharpstown, world's largest residential development near Houston, Texas, this Parsons Trenchliner worked 10 hours a day, 6 days a week. The F & C Equipment Co., Inc., which relies heavily on Caterpillar equipment, specified a Cat D315 Engine as original power. Field superintendent G. M. Strickler reports: "This is a big job and it takes the best equipment. We have to have something to produce with—and we find that Caterpillar units are the best so far!"

There's a reason they're "best so far!" Combining research with practical experience in the field, Caterpillar constantly improves its products to offer you the most modern equipment. Take its new line of heavy-duty engines, for instance. These rugged units are built to outwork comparable size engines of other makes. They pack more working power. They're sturdily built with such details as complete filter protection, bearings made of a special aluminum alloy, cylinder liners "Hi-Electro" hardened and chrome-faced piston rings. They use low-cost fuel without fouling. As a result, whether you use them in a ditcher, excavator or any other type of construction machinery, you can depend on them for big production at minimum cost.

Leading manufacturers of construction machinery are supplying Cat Diesels as original power. Or your Caterpillar Dealer is ready to install them as replacement power. A full line is available, capable of producing up to 650 HP (maximum output capacity). See your Caterpillar Dealer for details about these modern heavy-duty diesels!

Caterpillar Tractor Co., Peoria, Illinois, U. S. A.

CATERPILLAR*

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MODERN HEAVY-DUTY CONSTRUCTION POWER

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New! **WARN LOCK-O-MATIC HUBS**

New Convenience with AUTOMATIC FREE-WHEELING 2-WHEEL DRIVE and AUTOMATIC 4-WHEEL DRIVE forward and reverse AS YOU SHIFT!

Plus "Locking" controls for 4-wheel drive engine braking control safety.

Over 75,000 Warn Hubs in use

Stop front-end drag in 2 w. d.!

Your 4-wheel drive with Warn Hubs is the *only* vehicle you can own that has *all* the advantages and usefulness of *both* a 2 and 4-wheel drive. It has pep, speed, handling ease, economy on the highway in 2-wheel drive—and full-power traction in the rough going in 4-wheel drive. You save on equipment and operation. You get maximum use of your vehicle. Your dealer has Warn Lock-o-matic or Locking Hubs. See him or write us. Willys models sold exclusively by Willys dealers.

WARN MFG. CO. Riverton Box 6064 — R56 Seattle 88, Washington

. . . for more details circle 303, page 16

GILSON USERS SAY:

"YOU GET GILSON" FOR SIZE CONTROL

With the GILSON Mechanical Testing Screen you can size-test every shipment of highway aggregate—quickly and accurately—right on the job.

A questionnaire to GILSON users, many of them owners of several screen units, showed that 97.5% not only approve GILSON testing, but highly recommend it to others.*

The GILSON Screen pays for itself many times over. It does the job *fast*—five minutes or less per complete test; handles up to one cubic foot of sample—crushed stone, gravel, slag, coal, ores.

A sand attachment for handling 8-inch sieves is optional equipment.

Here's why you want GILSON:

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2. Two to seven separations simultaneously
3. Screen trays independently removable
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5. Visible separation to refusal
6. Few moving parts
7. Sturdy construction
8. Size range 4" to 200-mesh

Write for information and prices

**The remaining 2½% includes 1% who found GILSON performance satisfactory but reserved recommendation, and 1% with no comment.*

GILSON SCREEN CO. MALINTA, OHIO

. . . for more details circle 310, page 16

Personals

(Continued from page 164)

ROBERT W. SWEET has been appointed deputy chief engineer of the New York State Department of Public Works. Mr. Sweet, who was formerly district engineer at Watertown succeeds Claire Smith who died recently. Mr. Sweet entered state employment in 1923.

William C. Bassette has been appointed acting district engineer in Watertown, as part of the staff realignment. And Frank J. Fuller, Jr., becomes assistant district engineer, with M. Nicholas Sinacori advancing from associate soils engineer to principal civil engineer at Albany.

JOSEPH C. FEDERICK has been appointed district engineer of the New York State Department of Public Works at Binghamton, succeeding Frank W. Donovan, retired.

BERNARD A. LEFEVE is appointed district engineer at Rochester, relinquishing the post of director of the Bureau of Highway Planning and acting director of the bureau of research and statistics in the department's main office at Albany.

KURT G. RAUER has advanced from assistant district engineer to acting district engineer at Poughkeepsie, succeeding James S. Bixby who has retired.

JOHN P. H. PERRY, prominent for many years as a civil engineer, died recently in New York City at age 74.

He was the vice president and director of Turner Construction Company for many years and was, for a time, head of the Construction Facilities Division of the Munitions Board in Washington.

A former director of the American Society of Civil Engineers, Mr. Perry was a past president of the United Engineering Trustees and the Engineers Council for Professional Development.

EDWIN H. JONES, recently superintendent of maintenance in one of the Pennsylvania highway districts, has been appointed assistant chief engineer of the Pennsylvania department of highways in charge of maintenance.

R. A. Farley heretofore in charge of maintenance, has been transferred to acting chief engineer in charge of construction to succeed William A. Warrick who retired April 30.

Bituminous ROADS AND STREETS

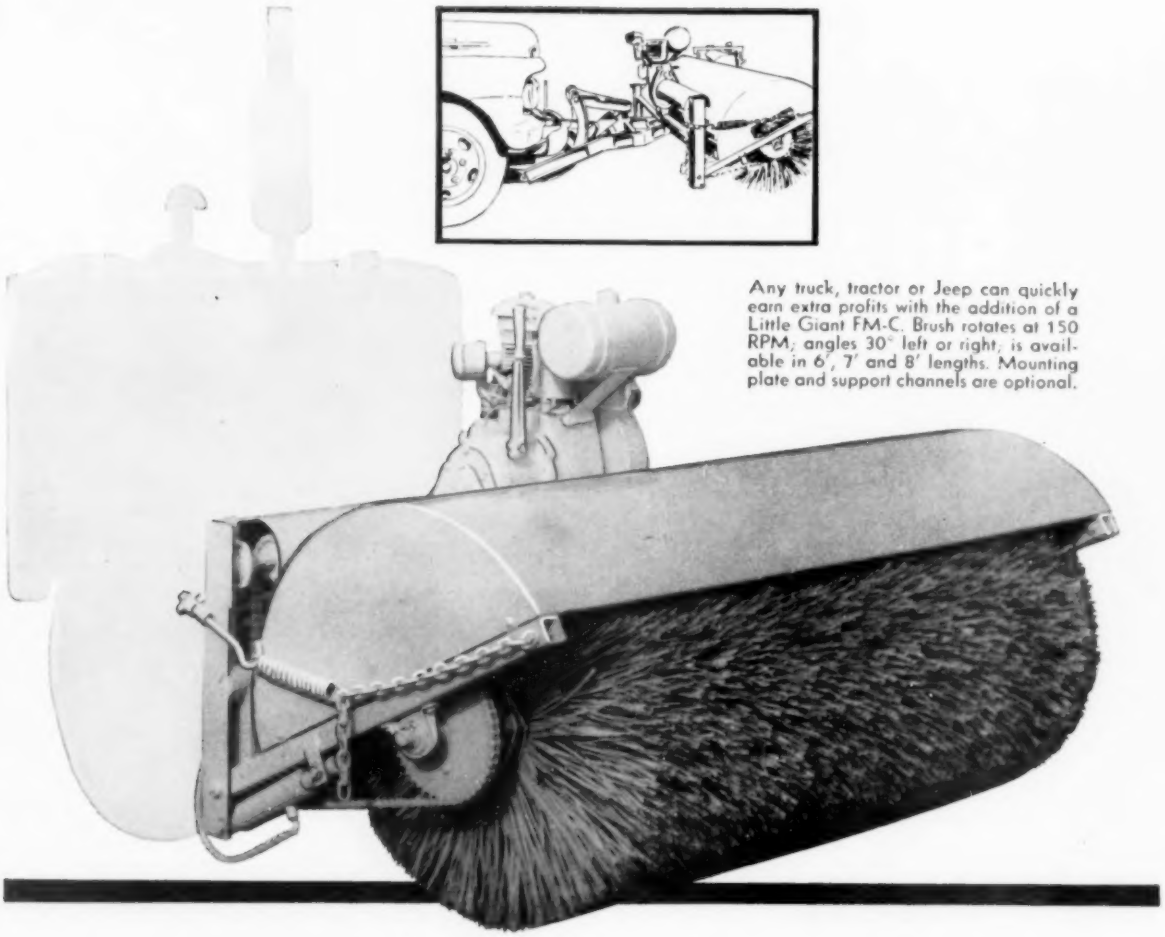
Street or highway? It's a "street" part of 1,000 miles for which the Kansas City (Mo.) municipal government is responsible, lying largely in the undeveloped North Kansas City area recently annexed from Jackson County. Substantial mileage each year is scarified, given RC-3 application with limestone chips, broom-dragged and rolled. Old roadbed usually contains some accumulated mat materials from annual dust laying.

Published by Gillette Publishing Company
23 West Maple Street, Chicago 10, Illinois

Testing Bituminous Mixtures — To Be Sure

Minnesota Reviews its Bituminous Effort

JUNE 1956



Any truck, tractor or Jeep can quickly earn extra profits with the addition of a Little Giant FM-C. Brush rotates at 150 RPM; angles 30° left or right; is available in 6', 7' and 8' lengths. Mounting plate and support channels are optional.

Another profitable use for your truck, tractor or Jeep . . .

THE *NEW* LITTLE GIANT *FM-C*

FRONT-MOUNTED SWEEPER

▶With a simple mounting attachment and a Little Giant FM-C Sweeper, you can convert any truck or industrial tractor into an efficient, low-cost sweeper. The brush is driven by an economical Wisconsin AEN gasoline engine; speed of brush rotation is adjustable independently of speed of prime mover.

The prime mover retains all of its maneuverability: low sweeper weight keeps the unit in perfect balance. Brush tilt and angling adjustments are easily made by one man.

With no PTO to connect, the FM-C sweeper can be attached or detached in a few minutes. Brush can be raised by the hydraulic system of truck or tractor, or the optional Little Giant hand hydraulic pump can be furnished.

Mount this NEW 6, 7 or 8 foot sweeper on your truck or tractor and increase your profits with the low-cost Little Giant FM-C Sweeper. ***Write direct for the name of your Little Giant distributor.***

LITTLE GIANT PRODUCTS, INC.

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. . . for more details circle 258, page 16

Alameda Naval Air Station – Photo courtesy Clyde Sunderland – Oakland

From Bay-bottom to airport runways at record low cost

BITUMULS®-treated sand/clay solves Navy paving problem at Alameda, California

TODAY, the runways of the Alameda (Calif.) Naval Air Station carry the heaviest of aircraft traffic, both in weight and volume.

Yet these same runways were constructed from sand/clay fill, dredged from the bottom of San Francisco Bay at a "bargain cost." The key to this performance and economy has been *Bitumuls Emulsified Asphalt Stabilized Base.* About 3 million sq. yds. of paved area at this Air Station have been built over a period of some 15 years; and during that time the savings as compared with alternate proposals have mounted to more than one million dollars.

Alternate methods considered by the Engineers of the Public Works Office were the construction of asphaltic concrete or macadam types that required the costly importation of crushed aggregate from long distances; or the treatment with Bitumuls of native red rock from the foothills. For these types over 500,000 tons of aggregate would have had to be imported for an average 5" depth of pavement base.

The dredged-in-place sand/clay from the Bay-bottom was stabilized with Bitumuls (about 6% average). This not only gave adequate bearing value at lower cost, but provided other unique advantages, such as:

1. **FLEXIBILITY,** for conformance to minor expected settlement.
2. **RESISTANCE TO ABSORPTION** of capillary moisture from the sub-base (only 3 ft. approximately above tide level).
3. **SPEED OF OPERATIONS** – Mixing Grade Bitumuls could be easily mixed with the damp sand/clay at record speeds compared to other types.

Bitumuls continues to be used at this Air Station in sand/clay mixes of varying designs to provide adequate load-bearing capacities for various types of pavement base. With increasing traffic and heavier loads, many of these areas have been surfaced with wearing courses, such as Asphaltic Concrete, Bitumuls Armorcoats or Surface Treatments.

An important factor in this very successful paving operation was the use of special grades of Bitumuls that are treated for use with hydrophilic or water-preferential sands. Full information on these products is available at a Bitumuls office near you.

Applying Bitumuls to windrowed sand/clay material. *(Official United States Navy Photograph)*

The Bitumuls-stabilized sand/clay is spread, then compacted to specified density.

American Bitumuls & Asphalt Company

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LEADING MARKETERS OF ASPHALTS, CUTBACKS AND BITUMULS – NATIONWIDE

. . . for more details circle 180, page 16

the finisher that has laid a million miles of superior pavement

According to conservative estimates, the thousands of Barber-Greene Finishers throughout the world have started on their second million miles. This million miles has been laid under every conceivable condition, on all types of base, with all types of mix.

The many exclusive features of the Barber-Greene account for this performance record:

Top paving speed: The Barber-Greene will lay any mix as fast as any paving machine now in use with the same surface quality. Widest choice of laying speeds, including the lower speeds needed for difficult mixes, means every job can be done at the maximum speed.

Positive traction: Crawler mounting assures positive traction and steering control even while pushing loaded trucks up steep grades, on slippery primes or on soft bases.

Superior maneuverability: Short length and crawler mounting save valuable time in fast maneuvering or turning around, even in narrow streets or confined areas.

Ease of control: Operator has unrestricted view of truck dumping, material level in spreading screws, and finished mat.

Time-saving hopper: Receiving hopper is amply wide for fast truck changes and easy discharge, without spillage.

World-wide service and parts: Available from local stocks on short notice.

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Write for literature on the finisher that handles all your paving jobs at less cost.

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AURORA, ILLINOIS, U.S.A.

CONVEYORS . . . LOADERS . . . DITCHERS . . . ASPHALT PAVING EQUIPMENT

. . . for more details circle 188, page 16

VIEWS AND COMMENTS

By H. G. Nevitt

THE SPECIFICATION PROBLEM

WHEN contracting for road construction, especially pavements, the real interest is in the end product. The logical approach would then be to specify the kind, amount, and quality of this end product, leaving it to the manufacturer (the contractor) to produce this in the most efficient and economical fashion. Unquestionably when we can reach such a point, costs will be markedly reduced.

Unfortunately, there are great difficulties in this procedure and specification requirements on the finished paving are both limited and rare. This makes possible the production of an inferior end product from approved raw materials and construction methods. There is little question that much pavement is built which does not give the service, minimum maintenance costs, or other qualities which should result from the materials and labor put into the job. The one sure way to avoid the appreciable loss which this involves is to increase the number of end product controls.

However, such specifications are only logical if their approach is consistent. A desirable case for discussion of this whole matter is the Michigan specification limiting the reduction in penetration of the asphalt binder in the finished pavement, as compared to that supplied to the mixing plant.

The purpose of this specification is to avoid the laying of pavements which show undue hardening of the binder. This aim is logical and probably worthwhile, despite the fact that the contractor is always jeopardizing a great expenditure of funds on, not the over-all quality, but merely the properties, of a material beyond his control. This is because the pavement cannot be tested until the extensive manufacture it involves has been carried out. However, we question if the approach adopted to give this desirable end is in itself logical. If a pavement of minimum hardness is desired which will not show undue further hardening in a specified period of years, why are not these qualities specified, rather than simply the reduction in penetration after mixing and laying?

The reply to this criticism will presumably be that the present approach prevents overheating in the mixing and forces the use of suitable asphalt. The first may be true, but the situation would be brought out, as well as any intrinsic unsuitably of the asphalt, by a time hardening test on the finished mix. The approach definitely does not in itself assure the best quality of asphalt, narrows the contractor's purchasing, and may eliminate asphalts which are quite satisfactory. Unless expensive refining is resorted to, some asphalts have a slight content of volatile which will be lost in the mixing operation. If such asphalt, of the proper penetration, is used, the finished paving mixture can have a binder of the correct consistency which may stand up far better than another asphalt which hardened much less in mixing but continued to oxidize in later years. This point will be discussed in detail in the near future; but in brief, it may be said that this specification is an improvement as compared to the present general lack of any requirements on hardening, but fails to provide the logical controls.

Right Specifications Needed

The path to the kind of specifications really needed for maximum quality at minimum cost is undoubtedly a long and hard one. It will not be traversed quickly, but slow and steady progress is possible. The important thing is that logic and consistency be adhered to at every point, that each step not merely represent an improvement but likewise the most logical one which can be taken.

Above all, specification requirements must be avoided which have no real connection with the quality of the finished pavement, but primarily represent an interference with the contractor's freedom to get the desired end result in the fashion which he finds best from this standpoint. The existence of such specifications is always denied; but we suspect there are many requirements on the books today which in plain language represent nothing more than the desire of the specification writer to dictate his way of getting things done to the man who has to do the job, without any proof that this improves the end result if suitable controls are set up.

This is the country of free enterprise. Its achievements are notable. Specifications which describe the desired end product or result are essential. Those which limit the producer of these end results from obtaining them in his own fashion are contrary to our whole system of getting things done. They are costly, and hence a deprivation of the taxpayers' right to get the most transportation possible for the least money.

Check the Distributor

As we have before noted, about the most frequent example of poor results from suitable materials and equipment appears in the use of that common facility, the distributor.

Presumably the usual — but not necessarily every — distributor can spread a sufficiently uniform film of asphalt over the sprayed area when the spray bars are clean and properly adjusted. How many in actual practice fail to do this? An alarming number, we fear.

Spray bars do vary considerably in the ease with which they may be kept clean and functioning properly. Not merely should the equipment be inspected previous to use to see that it can do the job expected of it, but likewise the actual results being obtained should be checked from time to time. How often is this done? Not frequently enough, in many organizations.

A thorough study of this matter, to raise present standards or set up new ones, and perhaps to evaluate the merits of different types of units, might be a very rewarding project for the AASHO.

Meanwhile every engineer on whom the responsibility falls can do a lot to improve distribution by simply giving the matter some attention, which should include tests of actual performance under operating conditions through the use of paper strips. If he has never run these, the results on his equipment may surprise — if not shock — him.

This matter merits some real attention.

• More than 78% of vehicles involved in fatal accidents in 1955 were traveling straight ahead.

Comment By G. L. Oliensis on H. G. Nevitt's Article On "The Spot Test"

To the Editor:

I note that Mr. Nevitt, in the April 1956 issue of ROADS AND STREETS, has made a vigorous attack on the usefulness of the Spot Test, going so far as to call it a "bogus" test. I feel that a few words on the subject from the originator of that test would be in order.

Let us first see what claims have been made for that test and what arguments Mr. Nevitt has advanced to prove that that test and those claims are, in his words, "bogus."

When I first proposed that test at the annual meetings of the A. S. T. M. in 1933, I had pointed out that asphalts may be subdivided by that test into relatively homogeneous and relatively heterogeneous groups, and that overhead asphalts and cracked asphalts were two of the several types in the latter category. No one can to this day deny the correctness of these claims.

Those who opposed the test at the time nevertheless kept attacking it on the ground that some asphalts that were not cracked and not overheated also failed to pass that test, and that therefore the test was useless. Of course my invariable reply was, in 1934, in 1936, in 1939, in 1941 and on many other occasions, that it had never been claimed that cracked or overheated asphalts were the only ones that failed to pass that test; for as I stated in my 1941 paper, "The fundamental function of the Spot Test is to determine, not whether an asphalt is cracked, or overheated, or weathered, or improperly synthesized, but primarily whether its internal phase relationship is relatively stable (as indicated by a 'negative' spot) or relatively unstable (as indicated by a 'positive' spot). It is true that the spot test has been found very useful in detecting cracked or overheated asphalts; but that has been solely because the latter happen to be the only common types on the market whose internal phase relationship is relatively unstable (under the certain standard conditions of the test as to dilution with a specified dilutent), the other relatively unstable types being much rarer."

In the paragraphs following the above quotation I went over every single one of the arguments that had been leveled against the Spot Test by its opponents in the then eight years since its publication. Practically all the arguments used by Mr. Nevitt were there discussed and shown to be untenable in the light of the specific claims that had been made for the test; and I therefore cannot understand Mr. Nevitt's now exhuming those same arguments after 15 long years in a renewed attack upon it.

Effect of Solvent

Mr. Nevitt cites the argument, for example, that an asphalt that tests positive when using the prescribed standard Skellysolve "S," will test negative if a stronger solvent is used. In this he is undeniably correct, for Skellysolve "S" was purposely chosen to play the role, not of a solvent, but of a disruptive agent (or "flocculant," as it would be called in technical language) — but the role of a disruptive agent so mild that it would *not* disrupt the internal equilibrium of a homogeneous asphalt like the normal steam-refined or steam-and-vacuum type, for the simple reason that in the latter the internal phase relationship (that is, the equilibrium between its various components) is so stable that it will withstand that mild disruptive force successfully; whereas in a cracked or overheated asphalt having a poorer internal equilibrium, that equilibrium would be too unstable to stand even the mild disruptive effect of the Skellysolve "S," and the characteristic black "spot" would consequently be rejected or precipitated from it.

It is self-evident that if instead of using Skellysolve "S," one used a solvent that was so strong that it could dissolve or digest *anything* bituminous, even the heaviest and most refractory asphaltenes, it could easily digest or dissolve *all* the ingredients or components of an asphalt no matter how loosely or unstably they were held together in the asphalt itself. Therefore the use of a strong solvent instead of the standard Skellysolve "S" as the dilutent actually defeats the purpose of the Spot Test, for it would be just as well not to run the test at all as to use a strong enough solvent that will *prevent* the very precipitation that we are looking for in the less stable asphalts.

Again, Mr. Nevitt uses the argument that one can add certain resinous bodies to a positive asphalt and make it test negative. But that is exactly what can and should be expected. For the resins act as plasticizers, or homogenizers, and therefore actually increase the homogeneity of the asphalt to which it has been added. For that very reason it will be *bound* to test negative. Again, he states that if you remove from a negative asphalt certain of its resinous bodies you will make it test positive. That too is exactly what can and should be expected; for by removing those stabilizing or homogenizing resins, you *decrease* the homogeneity of the asphalt and thereby make it *heterogeneous*. For that very reason it will be bound to test positive.

Mr. Nevitt does admit that cracked asphalts have frequently failed in service. He attributes this to their being too volatile, but he apparently does not recognize that their excessive volatility is part and parcel of their inherent heterogeneity. He also claims that some negative asphalts have failed when applied as sealcoats, but he does not concede that their failure could be directly due to the consistency selected having been entirely inappropriate for the service intended. A thin oil, for example, may be negative, but it certainly would be unsuitable for use in an asphaltic concrete pavement.

Purpose of Test

One can see, therefore, how readily all these various arguments that have been advanced against the Spot Test can be refuted, provided one only thinks clearly and objectively, and in addition bears in mind just what the true function of the Spot Test is — namely, to reveal whether an asphalt belongs to the class having a relatively stable, or a relatively unstable internal equilibrium, just as we had claimed for the Spot Test from the first.

But just what practical value, it may be asked, is there in using asphalts having this greater homogeneity or more stable internal equilibrium? I have in the past been extremely conservative in my interpretation of the significance of the Spot Test; and in the more than 20 years that it has been before the public I have been restricting myself solely to the rather

(Continued on page 189)

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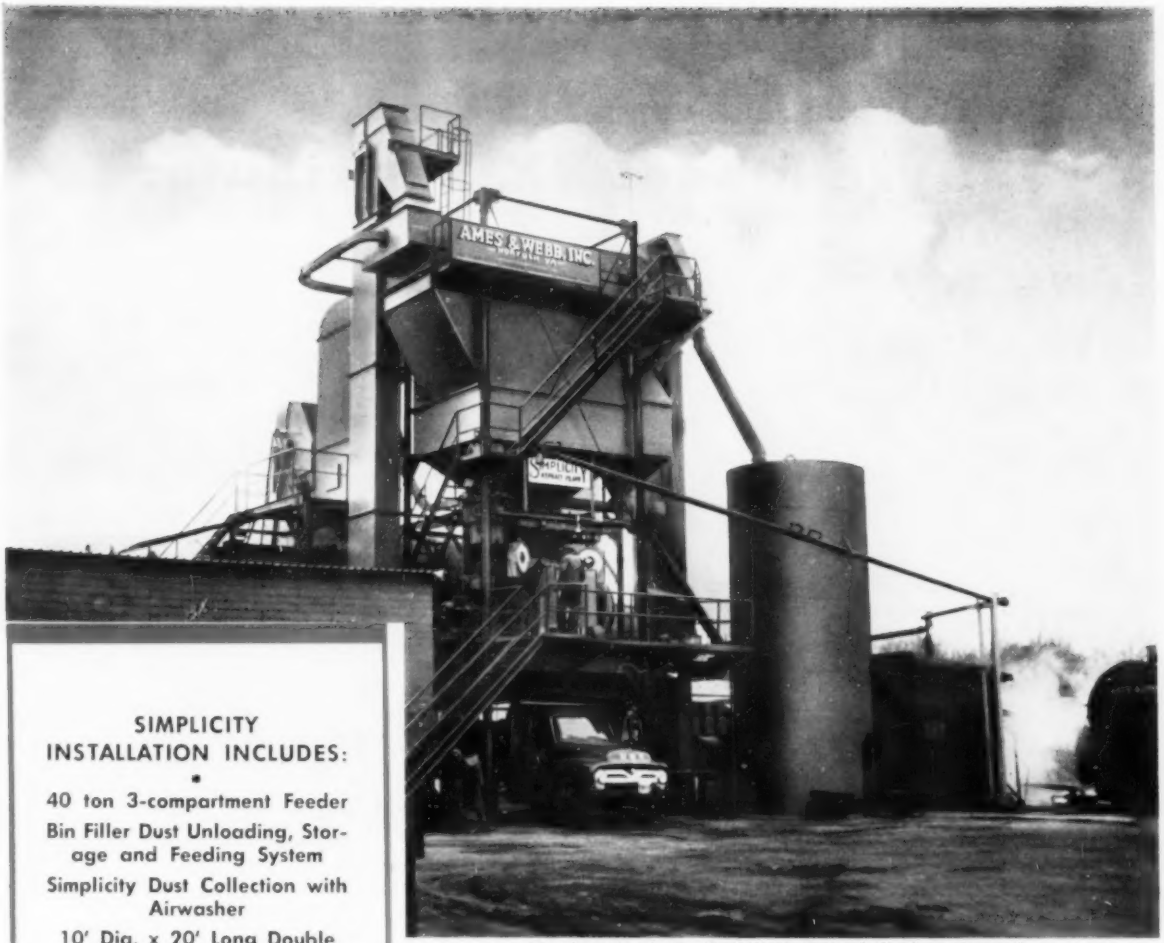

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Testing Bituminous Mixtures—To Be Sure

By Merle L. Nelson

Highway Engineering Associate, Materials and Research Department
California Division of Highways, Sacramento

The importance of helping inspectors and plant men "think around" their jobs is stressed by this author – who warns of over-simplification of procedure and outlines some of the things that will happen if quality controls are relaxed.

IN THE article entitled, "Paving Plant Inspectors or Paving Materials Engineers?", which appeared in the November 1955 issue of ROADS AND STREETS, the writer attempted to stress the importance of placing asphalt paving plant control on a basis whereby the inspector would concentrate his efforts toward controlling the paving mixture by means of physical tests and sound analyses of the test results.

While judging the performance of a test and making an analysis of the results obtained required training for inexperienced personnel, the technique of making the test can be mastered in a relatively short time. With detailed step-by-step instructions available, the operator can soon learn to perform most tests satisfactorily without any great deal of effort.

There are also, of course, certain basic test values required by the specifications governing the job. This means that the inspector simply compares the test values he obtains with those specified. Up to this point everything has been pretty much a mechanical process, the testing procedure has been established, the required values set by experienced materials personnel, and the inspector has been the operator.

With appropriate test methods and the performance of a sufficient number of tests, we have at this point established the foundation for controlling a paving mixture from an engineering viewpoint.

Now, for the inspector to realize the significance of the results he has obtained from a test, we must go back and understand some "first things first." I would imagine that there is not a man alive who long would be contented or do a good job just performing a test, knowing little or nothing of the reasoning behind the test or the significance of the values he obtains.

It has been the experience of the writer that if you take an inspector on a paving plant and simply teach him how to perform the tests, and inform him as to what values must be obtained to satisfy the specifications — and not instill in him sufficient knowledge of the test, so that he is able to form from the results an objective picture — you will soon have a man who complains that the test is too intricate and complicated just to arrive at a numerical value. He shortcuts and omits, and finds an easier and faster way, and you end up with questionable results produced by a mechanical operator — and the aforementioned foundation for the engineering approach has been lost.

It is fairly obvious that field control tests should be as simple and rapid to perform as possible, especially in view of the pace set by modern-day contractors. There is, however, a limit to the simplification and rapidity which can be applied to any test if you are to arrive at dependable results.

It is the contention of some experienced old-timers that the average young construction engineer of today is reluctant to spend sufficient time and effort in thoroughly performing and analyzing a test, but rather would prefer some effortless crystal ball method of predetermining the results.

The following discussion is directed primarily toward the engineer who is or will be assigned the job of inspector on an asphalt paving plant. In this discussion it is only natural that the writer reflect the opinions, policies and procedures of the California Division of Highways, not with any implication that these are necessarily superior but rather to set up an ex-

● Raveling: Can be caused by any one or all of the following: insufficient asphalt, clay coatings on the aggregates, or soft particles which disintegrate when wet. Asphalt film stripping from aggregate is a cause of raveling.

● Unstable Pavement: Can be caused by an excess of asphalt, moisture or extremely fine material, resulting in a very dense and lubricated mixture.

ample of inspection from a materials engineering point of view.

There are numerous test methods used in different parts of the country to evaluate bituminous mixtures, and no attempt will be made to pass judgment on the merits of any. However, I think that we can draw from the vast experience and knowledge of nationally recognized men in the field of bituminous paving mixtures in establishing the fundamental requisite for a satisfactory bituminous pavement.

The methods of testing for these qualities we will leave to the materials organizations, to select one of the several approved procedures or develop new ones.

Test Objectives?

It seems most logical that if the inspector is to test, evaluate and control a paving mixture he must have an objective. In other words, what are the qualities we are looking for in a paving mixture, how do we go about getting them, what controls should we apply, and what tests will tell us what we must know in the control process? Of equal importance — and a point which always lends emphasis to any control process — is, what are some of the things which can be expected of the mixture if quality controls are not maintained?

First, let us establish some of the most important qualities which a satisfactory bituminous mixture should have.

The mixture should be stable, meaning that it should not groove, or deform under action of vehicles.

The mixture should be durable, meaning that it should provide a pavement having adequate resistance to the destructive action of weather and water for a long period of years.

The mixture should provide a pavement having an adequate traffic safety component due to a reasonably non-skid texture. A satisfactory surface mixture should not ravel or fail from abrasion.

It would now seem a proper approach for the inspector to know how these qualities are achieved in a paving mixture and how he goes about maintaining them by testing and analyzing the results.

Mr. F. N. Hveem, materials and research engineer, California Division of Highways, says: "High stability results from a mineral aggregate in which the rock particles are relatively rough and which possess a high degree of friction to resist sliding between adjacent particles. This friction must not be reduced by adding too great a quantity of lubricant to the aggregate; in other words, an excess of asphalt or water or both will lubricate the mixture and the particles will move about with considerable facility, the result being an unstable pavement.

"The effect of lubricants, i.e., oil or water, is greater when the particles are small and the points of contact numerous than when the particles are coarse."

A durable mixture which will not ravel or fail from abrasion is one containing a *proper* and *uniform* amount of asphalt with all particles thoroughly coated with asphalt. It must be free from soft particles which may disintegrate in the presence of water and the aggregate particles must be free from clay coatings.

A reasonably skid resistant surface cannot have an excess of fines or asphalt which will result in a "bleeding pavement" caused by the excess fines, and/or asphalt flushing to the surface under the action of traffic, thus providing a smooth slippery mat.

Understanding Tests

The foregoing are the basic qualities which seriously affect the success or failure of a bituminous pavement. While specification requirements establishing these qualities are often based on laboratory tests prior to starting a project, they must be understood by the inspector if he is to perform control tests in the field and analyze the results.

At this point let us assume that the inspector has an understanding of the fundamental qualities which go to make a satisfactory bituminous paving mixture, and is able to recognize the indications of such qualities in the test reports which he should have in his possession on arrival at the plant as the inspector.

Let us assume that the test reports show the mixture (graded to specification requirements) to be stable. In California, this would mean a Stabilometer Value of 35 or more. The Sand Equivalent Values is over 50, which indicates the absence of harmful clayey like materials. The Centrifuge Kerosene Equivalent Test shows 5.5% of asphalt to be the approximate optimum amount for the mix. Here we have four things contributing to a satisfactory paving mixture, and all four of them controllable by the inspector through a properly executed program of testing and adjustment of plant operations.

The inspector can control and maintain the desired grading and aggregate proportions by frequent and careful sampling and sieve analyses of his stock aggregates. He can detect certain changes in the quality of his fine aggregates by performing the Sand Equivalent Test. He can predetermine the proper asphalt content by the Centrifuge Kerosene Equivalent Test. And by means of the extraction test he can assure himself as to whether or not the asphalt is actually finding its way into the mixture. By using these control tests to maintain the pre-determined quality of the mixture, the inspector is assured of a satisfactory paving mixture.

Results obtained from control tests will quite naturally be at some variance to the preliminary test values,

because of fluctuation in the natural characteristics of any aggregate source. What the inspector must know is, what do certain variations in test results mean in terms of the completed pavement and its service behavior.

Probably the sieve anlysis is one of the most important of control tests. The test does not require any great amount of skill to perform, and any conscientious operator can find out how much of each size group exists in the mineral aggregate.

The inspector must understand that any appreciable change or variation in gradation will be reflected in a change in some other characteristics of the mixture, such as a deficiency or an excess of asphalt, or even a loss of stability if the variation is great enough.

The inspector can perform the C.K.E. Test and determine the proper amount of asphalt for any variation in grading. However, he must know also *what may happen* if the gradation wanders too far from the pattern of his preliminary test results, which establish the mix he is attempting to control.

The mixture can become coarse to the extent that it will be harsh and will segregate easily, will be difficult to finish and may provide a noisy pavement. On the other hand the mixture if allowed to become too fine and dense will become critical with regards to asphalt content and stability.

Summing Up

To sum it all up, we may offer the following conclusions:

We recognize that we cannot detect the essential properties of a paving mixture just by looking at it. Therefore, we must have tests and specific test methods for evaluating the paving mixture in the preliminary or design stages. We must continually repeat certain of these tests and procedures as control measures, if we are to maintain the benefits of the preliminary tests. In view of this conclusion, the inspector will, under a control testing program, perform as many daily sieve analysis tests on the aggregate supply source as are necessary to keep him completely informed as to what is going into the paving mixture.

He will perform the C.K.E. Test each time his sieve analysis indicates a change in the characteristics of his aggregates. And in any case he will perform sufficient C.K.E. Tests to assure that the amount of asphalt going into the mixture is correct for aggregate coming into the plant.

- Most laboratory testing personnel desire to know the reasoning behind the routine work they are doing.
- Test routines are relatively easy to master, but special training is required to learn to analyze and judge test results.
- This article reviews the chief test objectives for bituminous paving mixtures: for indices of stability, durability, surface texture.
- Also reviewed is the reasoning behind the California standard tests: the standard sieve analysis, for gradation control; Sand Equivalent Test, for harmful clayey content; the Centrifuge Kerosene Equivalent Test, for best asphalt content.
- And the adverse results if quality controls are not made at frequent intervals and properly interpreted, are stressed in Mr. Nelson's article.

He will perform sufficient Sand Equivalent Tests to keep himself well and constantly informed of the quality of his aggregates insofar as chance inclusion of detrimental clay like material is concerned.

As a final and positive check on the composition of the completed mixture, the inspector will perform the extraction test which will show the asphalt content and the moisture content of the mix after which a sieve analysis can be made on the extracted aggregates.

If these control tests are performed diligently and with a frequency consistent with the materials source the inspector will be at all times in a position of control and the service life and appearance of the bituminous pavement will repay many times the cost of the control testing program.

- The awarding of $42,748,000 in highway projects in a single letting was planned for June 7 by the New York State department of Public works.

The job included 25 projects totalling 91 miles of work in 21 different counties.

Tricky Paving Job for Ford Test Track

- **Building the 5-mile high-speed test track at Ford Motor Company's new Arizona Proving Ground involved so many special problems that the road project came to be known by the construction gang as "Aspirin Oval." The embankments are so steep it was necessary to steady heavy rolling equipment by fastening it with cables to tractors on the rim above the track. To avoid ridges in the surface of the banks, the rollers of the 50-ton compacting machines had to be adjusted frequently so they would fit the changing contours. This was the first time such a paving job had been performed using asphaltic concrete.**

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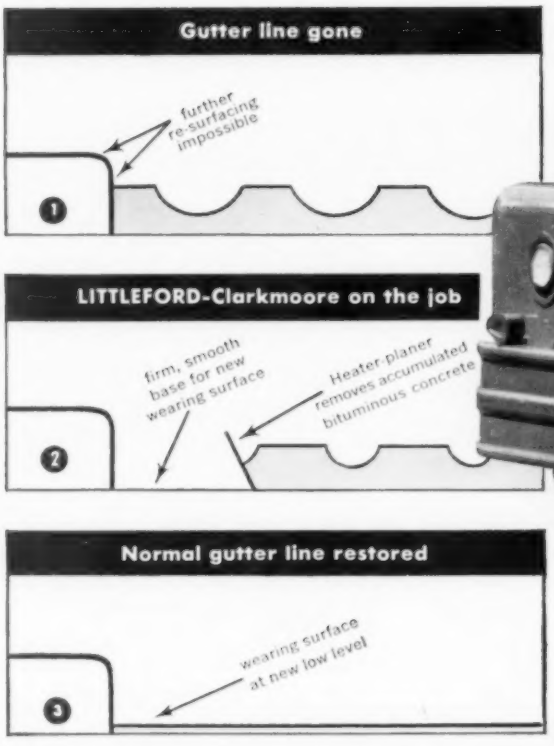

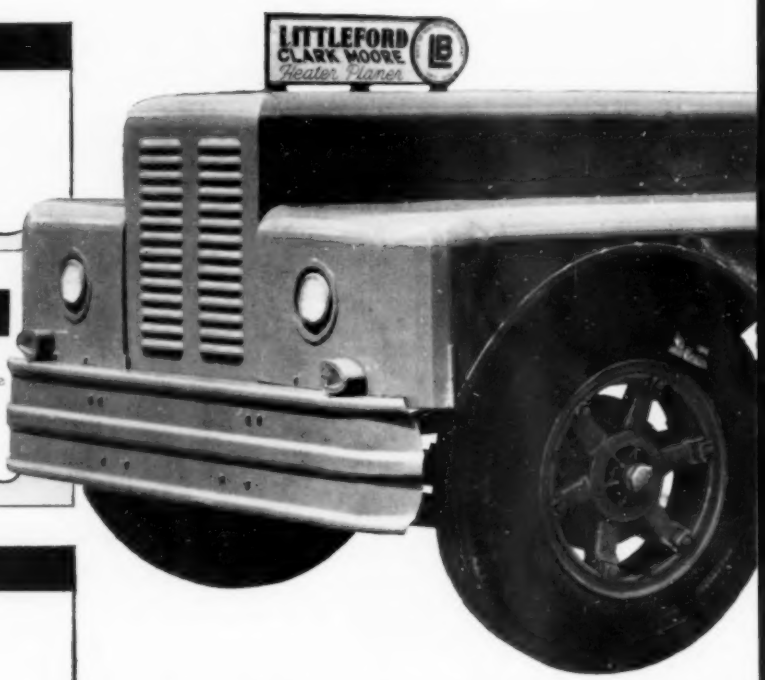

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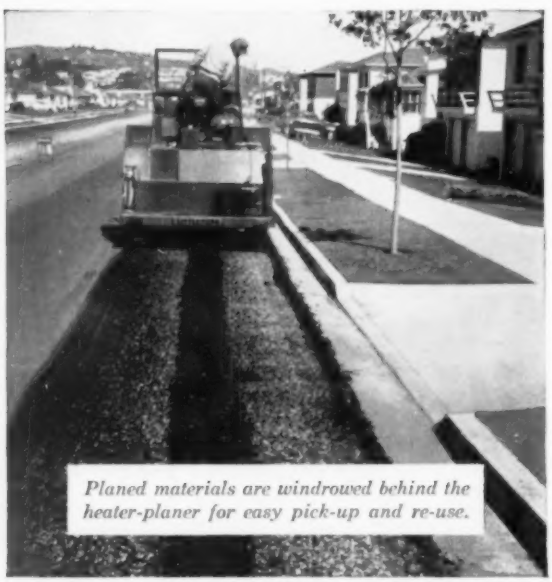

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TOPS IN BLACK TOP

for more details circle 257, page 16

Minnesota Reviews its Bituminous Effort

Annual summary and appraisal of hot-mix and sealing projects reveals interesting figures on material tonnages, contractor participation, construction methods, and riding qualities obtained on 1955 projects.

OVER 21,000,000 gallons of liquid bituminous material and 46,000 tons of asphalt cement and heavy road oil (SC-5) were used in Minnesota's 3,472-mile state highway construction program during 1955. Approximately 946,000 tons of hot plant-mix construction was completed during the year on jobs totaling 526.9 miles. Table 1 shows the charted year's accomplishment, as tabulated annually in a review prepared by the materials and testing laboratory staff for departmental use.

● *Hot Plant-Mix Production.* The following is a summary of plant-mix production for the 1955 season:

Specification 2351 — Hot Asphaltic Concrete . . 39,835 Tons
Specification 2341 — Plant Mixed Surface (Divided Aggregate) . . . . . 358,281 Tons
Specification 2331 — Plant Mixed Surface (Single Aggregate) . . . . . 547,559 Tons

This information was excerpted from the Minnesota Department of Highways, Division of Materials and Research, Technical Bulletin No. 26, March 15, 1956, D. R. McFadden, Bituminous Engineer.

Nineteen bituminous contractors using 24 hot mix plants participated in the construction of 73 projects. Nineteen of the plants were of the continuous mix type and five were of the batch type. One contractor using three plants, two continuous mix type and one batch type, produced 221,183 tons of mixture or approximately 23 percent of the total for the season.

Plant production rates ranged from a low of 31 tons per hour to 200 tons per hour. Average production per plant was 121 tons per hour. The 24 plants operated a total of 1,167 days in producing the season's hot mix production. Average production per plant for all plants for the season was 39,400 tons. Production for individual plants ranged from a low of 1,393 tons to a high of 102,725 tons. Eleven of the 24 plants produced in excess of the average for the season.

Ninety percent of the production was accomplished during the period from June 1 to November 1, including 19 percent being produced in October.

Table 1
1955 Bituminous Road Program on Minnesota Highways

	By Construction Division	By Maintenance Division Contract	State Forces	F. A. S. By Counties	Totals
Spec. 2351 Hot Asphaltic Concrete	6.8	3.0	—	—	9.8
Spec. 2341 Hot Divided Aggregate Plant-Mix Surface	132.8	—	—	—	132.8
Spec. 2331 Hot Single Aggregate Plant-Mix Surface	346.2	—	—	38.1	334.3
Spec. 2321 Road-Mixed Surface	118.2	42.9	469.9	439.1	1070.1
Spec. 2207 & 2208 Road-Mixed Base	223.6	1.6	11.4	61.4	298.0
Spec. 2356 Heavy Seal with Cover	52.7	128.9	—	102.4	284.0
Spec. 2357 Light Seal with Cover	178.9	440.8	260.1	21.6	901.4
Spec. 2356 (Mod.) Double Seal with Cover	8.0	0.7	0.2	—	8.9
Fog Seal without Cover	148.9	13.1	10.1	210.8	382.9
TOTAL MILES	1216.1	631.0	751.7	873.4	3472.2

● *Road-Mix Construction.* Approximately 345,000 tons of road-mixed construction on 350 miles of trunk highways was completed during the 1955 season. This total consisted of 147,000 tons of road-mixed surfacing and 198,000 tons of road-mixed bituminous base. Twenty-one contractors participated in road-mix construction.

During the past season two projects were constructed using inferior granular materials because of the lack of more desirable material within economical haul distance. On one project, the upper 3 in. of depth was stabilized with RC-2 at the rate of 3.5 percent, placed in two 1½-in. layers. The contractor elected to set up a pug-mill at his screening plant, mix the bituminous material into the aggregate immediately upon discharge from the screening plant, and haul the mixture to the road. Production ranged from 150 to 200 tons per hour. The bituminous stabilized base was then covered with a 1½-in. plant-mixed surface.

On the second project, the upper 2 in. of material was stabilized with RC-2 at the rate of 4 percent. In this case the contractor elected to use a traveling plant for mixing. More of this type of stabilization is contemplated for the coming season with a trend towards increased thicknesses.

● *Bituminous Materials.* As has been the practice in the past, asphalt cement was used in all hot plant mixes, with the exception of one state project and one county F.A.S. project, where SC-5 liquid asphalt was used.

● *Riding Qualities.* Roughness recordings were run on 400 miles of new hot plant mix surfaces constructed during the season. Roughness, measured in inches per mile, ranged from a low of 47 in. on one project to a high of 73 in. on another. Average for the season's work was 58 in. Nineteen projects out of 32 had roughness recordings of 58 in. or less.

Roughness recordings were also made on eight projects for a total of 57 miles of road-mixed surfacing. Roughness ranged from a low of 82 in. to 154 in., with an average of 120 in. per mile. Four of the eight projects had recordings meeting the average or less.

● *Seal Coats.* A policy has been

PROJECT NO.	T.H.	LOCATION	LENGTH MILES	MIXER	ROUGHNESS	DENSITY		MAT THICKNESS		% VOIDS		BITUMEN				MINERAL FILLER		RUNNING AVE. NO. 10 SIEVE FIELD TESTS			PROJECT NO.
						FIELD	% LAB DENSITY	POUNDS PER SY	AVERAGE THICKNESS	IN MAT	IN AGG	IN FILLED	KIND & GRADE	% DES	% FIELD	% EXTRACTION HIGH	% EXTRACTION LOW	% EXTRACTION AVE	% TOTAL	% -200	NUMBER OF TESTS	% WITHIN LIMITS	AVE. VAR.	
		2331 PLANT MIX BITUMINOUS SURFACE (DIVIDED AGGREGATE TYPE) (CONTINUED)																		(+05-5)			
②6912-17 ETC.	35 37	EVELETH TO GILBERT & BIWABIK TO GILBERT	7.5	B-G	-	- 132 130 137 140 142	- - - 92.7 94.0	VAR B* 602 B* VAR L 154 B 152 W 201 W	VAR 6.08 VAR 1.50 1.45 1.89	- - - 10 9	- - - 21 20	- - - 54 54	AC 1 3.2 120-150	3.2 3.28 3.88 4.07 4.98 5.1	4.0 4.4 4.7 5.9	3.0 3.2 3.9 4.0	3.4 3.8 4.3 4.9	3.6	79.4	46 42 18 75	91 83 100 93	2.2 3.2 1.6 2.9	②6912-17 ETC.
6916-39 ETC.	53	IN INDEPENDENCE	0.6	B-G	-	132 137	93.8	189 B* 159 B 183 W	- 1.61 1.78	- - 11	- - 22	- - 50	120-150	3.5 4.0 5.2	3.38 3.94 5.19	3.9 5.4	3.7 4.4	3.8 5.0	3.6	67.5	6 5	83 100	2.7 2.6	6916-39 ETC.
①6917-30 ETC.	53	COOK TO 4.0 MI.N. OF VIRGINIA 1.8 MI. TO 0.9 MI.S. JCT. TH57	10.4	B-G	53	- 133 137	- - 97.2	VAR VAR L 157 B 150 W	VAR 1.57 1.46	- - 9	- - 20	- - 52	150-200	4.0 4.0 5.1	3.96 3.74 5.12	- 4.9 5.1	- 3.5 3.5	- 3.9 4.7			1 39 34	100 82 71	0.8 3.5 3.7	①6917-30 ETC.
②7002-16 ETC.	21 169 282	IN JORDAN	3.3	B-G	- - -	- 130 132 134 135	- - - 92.4 93.1	217 B* VAR L 149 B 203 B 159 W 205 W	- VAR 1.53 2.05 1.58 2.04	- - - 12 11	- - - 22 21	- - - 47 48	150-200	3.5 4.0 4.0 4.0 5.3 5.3	4.07 4.06 3.99 5.24	- - 3.9 4.2 5.1 5.3	- - 3.6 3.8 4.6 4.7	- - 3.8 4.0 5.0 5.0	3.7	84.6	4 10 23 35	75 70 96 86	2.7 4.6 2.9 3.6	②7002-16 ETC.
7011-04	282	IN JORDAN	0.4	B-G	-	- 136	- 93.8	- 160 W	- 1.57	- 10	- 21	- 51	150-200	4.0 5.3	3.93 5.24	- 5.1	- 4.9	- 5.0	3.1	84.5	6 6	83 83	2.3 3.1	7011-04
7311-40	52	WHITE PARK TO 1.8 MI.E. ALBANY	16.3	BATCH	53	- 138 144	- - 94.7	VAR L 167 B 165 W	VAR 1.61 1.53	- - 7	- - 18	- - 64	150-200	4.0 4.0 5.1	3.61 4.12 5.13	- 5.0 5.9	- 3.8 4.4	- 4.1 5.2	3.9	84.0	1 26 74	100 100 70	0 1.6 3.9	7311-40
7406-07 ETC.	65	IN OKATONNA	1.5	B-G	-	126 136	- 95.1	126 L 201 W	1.33 1.97	- 8	- 19	- 56	100-120	4.0 5.3	3.90 5.16	4.3 5.6	3.4 4.6	3.8 5.0	3.5	86.2	11 19	100 90	1.9 2.8	7406-07 ETC.
		2331 PLANT MIX BITUMINOUS SURFACE (SINGLE AGGREGATE TYPE)																		(+08-8)			
②0705-06 ETC.	30	T.H. 15 TO AMBOY	12.9	B-G	-	115	88.5	VAR L	VAR	-	-	-	AC 1	-	4.25	-	-	-			1	100	0	②0705-06 ETC.
0705-10	30	AMBOY TO MAPLETON	10.5	B-G	56	133	94.3	148 W	1.72	17	26	34	200-300	5.4	5.36	5.5	4.4	5.0			37	92	3.3	
0710-16	83	CANBRIA TO JCT T.H. 169	14.7	B-G	49	127 132 129	- 94.7 93.5	135 B* 151 W 148 W	1.42 1.53 2.06	- 11 13	- 21 23	- 50 45	150-200	3.5 5.3 5.3	3.5 5.3 5.3	4.4 5.5 5.5	2.9 4.6 4.6	3.1 5.0 5.1			67 9 65	91 88 80	3.3 3.2 5.3	0710-10 0710-16
1409-04 ETC.	82	BARNESVILLE TO 13.6 MI.S.W.	13.6	PIONEER	67	139	99.2	159 W	1.53	9	20	57	200-300	5.2	5.2	5.4	4.8	5.1			62	97	1.6	1409-04 ETC.
1905-11 ETC.	52	IN PINE BEND	0.7	B-G	-	129 128	90.8	150 B 152 W	1.55 1.58	- 16	- 26	- 39	150-200	4.1 5.3	4.06 5.23	3.9 5.3	3.4 4.4	3.7 5.0			5 6	100 100	1.5 1.3	1905-11 ETC.
2005-08 ETC.	56	KENYON TO WEST CONCORD	10.0	B-G	65	130 138 133	97.9 94.3	153 B 152 W 196 W	1.57 1.47 1.96	- 8 12	- 20 23	- 58 48	150-200	4.0 5.2 5.2	3.8 5.2 5.2	4.0 5.2 5.4	3.6 5.0 4.7	3.9 5.1 5.1			3 64	100 89	3.2 3.4	2005-08 ETC.
2108-03 ETC.	78	ASHBY TO BATTLE LAKE	17.0	B-G	60	133	96.4	151 W	1.51	11	21	49	SC 5	5.0	5.19	5.3	4.5	4.9			81	100	1.7	2108-03 ETC.
2207-07 ETC.	169	IN ELMORE	0.7	B-G	-	132	91.7	206 W	2.08	10	21	50	150-200	5.3	5.26	5.3	4.7	5.0			5	100	0.8	2207-07 ETC.

* Bituminous Base L — Leveling B — Binder W — Wearing Course. 1 Partially completed in 1955. 2 Partially completed in 1955 — to be completed in 1956.

● **Typical detail sheet on which is recorded essential test data used in evaluating success of quality control procedures in Minnesota.**

adopted by the department whereby the seal coats are withheld from the surfacing construction contracts. These new surfaces are to be sealed the following year either by contract or by maintenance forces.

In an attempt to determine if the addition of rubber to bituminous materials had any beneficial effects in seal coating a project was set up by the maintenance division for placement in 1955. Three carloads of three different rubberized RC-5 were used along with standard RC-5 for control comparison. The three rubberized cutbacks were as follows:

RC-5 plus 3% synthetic rubber latex blend.

RC-5 plus 2% natural rubber.

RC-5 plus 2½% mineral detackified rubber.

Application rates were about 0.20 gal. per sq. yd. of bituminous material and 18 to 20 lb. per sq. yd. of cover aggregate.

From observation, all of the materials appear about the same except for some slight streaking in the RC-5 mineral detackified rubber section.

Engineered for

World's most heavily traveled turnpike

The 118-mile New Jersey Turnpike, constructed with modern asphalt pavement, carried 25,888,319 cars and trucks in 1955. No other turnpike is so heavily traveled, yet this asphalt-paved superhighway is one of the safest heavy-duty roads in the world. Its 1955 safety record of 2.76 fatalities per 100 million vehicle-miles is far better than the 6.5 average for national highways.

ASPH

smooth, rugged service!

IN FOUR SHORT YEARS total traffic volume on the asphalt-paved New Jersey Turnpike has exceeded the total carried during the 15-year life of the Pennsylvania Turnpike, the grand-daddy of present-day toll roads.

Yet in spite of carrying more traffic than any other turnpike in the world, maintenance costs are low and the asphalt pavement is in excellent condition.

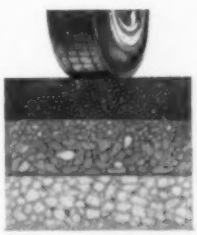
To highway engineers the New Jersey Turnpike's record of tremendous traffic and outstanding safety is a remarkable demonstration of the dependability of modern asphalt pavements for rugged, heavy-duty service.

Modern asphalt pavement saved $50,000 a mile on the New Jersey Turnpike. For one thing, material costs were less because, as is usually the case with asphalt construction, economical use was made of local soils and aggregates. This is one of the many benefits of asphalt's versatility. Also, asphalt construction is faster. Thus the road begins to earn revenue sooner.

Modern, heavy-duty asphalt construction is demonstrating that it offers economy, durability and ease and speed of construction. That's why more engineers are recommending asphalt pavements—engineered for smooth, rugged service.

Engineered for rugged wear

TYPICAL SECTION showing modern 4½" asphaltic concrete pavement on New Jersey Turnpike. Pavement structure designed from the ground up for axle loads of 36,000 lbs. Bids on asphalt design were $5,000,000 less than bids for 10" rigid pavement to carry the same loading.



4½" Asphaltic Concrete
7½" Asphalt Penetration Macadam
6½" Compacted Stone or Gravel Subbase

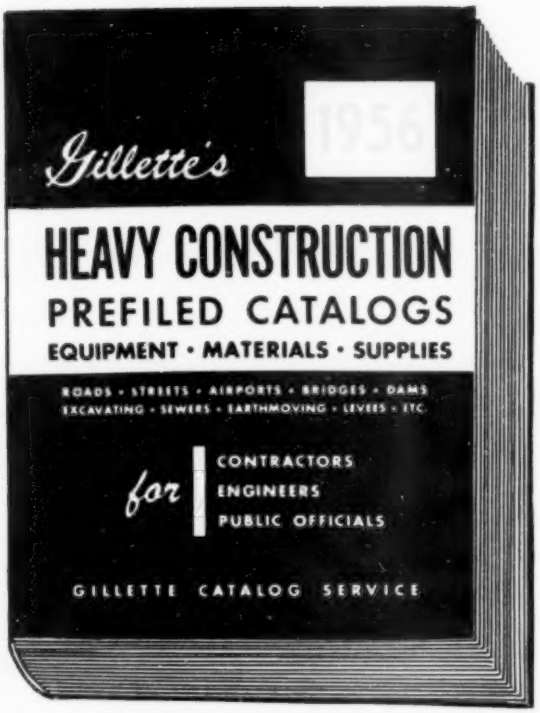
THE ASPHALT INSTITUTE
Asphalt Institute Building, College Park, Maryland

ALT

FOR MODERN HEAVY-DUTY HIGHWAYS

. . . for more details circle 319, page 16

RIBBONS OF VELVET SMOOTHNESS . . .



. . . and here are some reasons why you should be USING IT DAILY!

- Catalogs are PREFILED — Saving you time and space required to file individual manufacturers' catalogs.
- Saves you the time and inconvenience of writing to manufacturers for catalogs.
- Gives you all the facts needed BEFORE you make a buying decision.
- Manufacturers' names and trade names indexed alphabetically for quick reference to individual catalogs.
- All the buying information is 'boiled down' — designed for your convenience.

After checking the advantages listed above, you can see why this ONE CATALOG offers you so MANY advantages . . . saving you both time and money, not only in the mechanical and physical aspects of a cataloging operation . . . BUT MOST IMPORTANT OF ALL . . . it is available WHEN you NEED it . . . BEFORE you make your buying decisions! The manufacturers represented in this catalog are literally 'meeting' with you in your office — offering you all the information you could possibly need concerning their products. Why not meet them at least half way — and USE THEIR PREFILED INFORMATION!

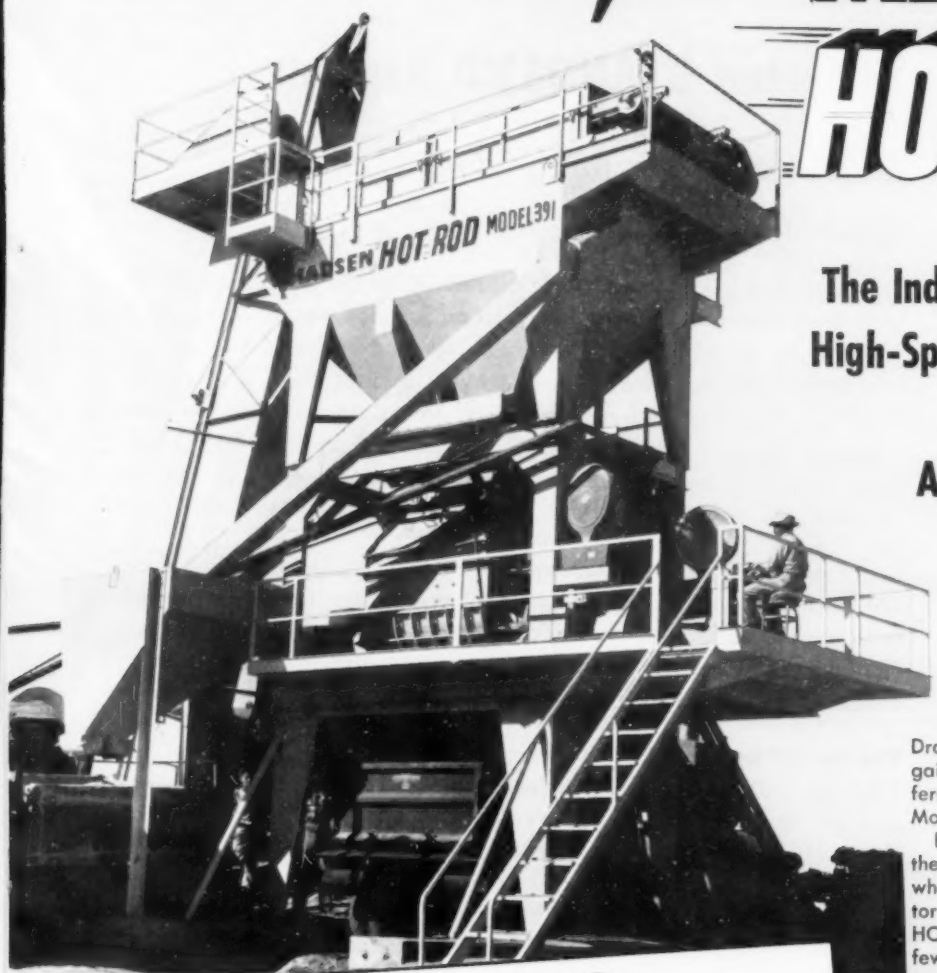
Here are the manufacturers represented in Gillette's Heavy Construction Prefiled Catalog:

American-Marietta Company
American Steel & Wire Div.
Anthony Company
Armco Drainage & Metal Products, Inc.
Arrow Manufacturing Company
Austin-Western Company
Baldwin-Lima-Hamilton Corporation
Barber-Greene Company
Blaw-Knox Company
Brisco Manufacturers of Calif.
Bros Boiler & Mfg. Co., Wm.
Buffalo-Springfield Roller Co.
Butler Bin Company
Carey Manufacturing Co., Philip
Chrysler Corporation, Industrial Engine Div.
Clark Equipment Company
Cleaver-Brooks Company
Cleveland Form Grader Co., The
Cleveland Trencher Co., The
Colorado Fuel & Iron Corp., The
Continental Motors Corporation
Cummer & Son Co., The F. D.
Cummins Engine Co., Inc.
Detroit Diesel Engine Div.
Electric Tamper & Equipment Co.
Flexible Road Joint Co., The
Flintkote Co., The
Gar-Bro Manufacturing Co.
General Motors Corp.
Goodall Rubber Company
Harnischfeger Corporation
Heil Company, The
Heltzel Steel Form & Iron Co., The
Henry Manufacturing Co., Inc.
Hough Company, The F.G.
Huber-Warco Company, The
Ingersoll-Rand
International Harvester Co.
Jackson Vibrators, Inc.
Joy Manufacturing Company
Keystone Asphalt Products Company
La Crosse Trailer Corporation
Le Roi Company
Le Tourneau-Westinghouse Co.
Littleford Bros., Inc.
McKiernan-Terry Corporation
Mid-Western Industries, Inc.
Minneapolis-Moline Company
Naugatuck Chemical Div.
Owen Bucket Company, The
Phoenix Products Company
Pioneer Engineering Works, Inc.
Prehy Company
Republic Steel Corporation
Rogers Brothers Corp.
Seaman-Andwall Corporation
Servicised Products Corp.
Shawnee Mfg. Co., Inc.
Stow Manufacturing Co.
Symonds Clamp & Manufacturing Co.
Timken Roller Bearing Co., The
Toncan Culvert Manufacturers Association
United States Rubber Company
United States Steel Corp.
United Steel Fabricators, Inc.
Wellman Engineering Co., The
Westinghouse Air Brake Co.
Wick Wire, Spencer Steel Div.
Wico Electric Company
Williams Bucket Div.
Williams Form Engineering Corp.
Wisconsin Motor Corporation

NOW! . . . out of 40 years' experience in manufacturing Asphalt Plants . . .

COMES A NEW
3000-lb., 4000-lb., 5000-lb.
BATCH CAPACITY PLANT

the Streamlined
MADSEN HOT ROD



The Industry's Most Modern High-Speed · High-Production Fast-Moving ASPHALT PLANT

MADSEN DOES IT AGAIN!

Drawing upon experience and knowledge gained over the years, MADSEN now offers the sensational MADSEN HOT ROD Model 391 Asphalt Plant!

It's a versatile plant designed to handle the broad requirements of the contractor who likes to move as well as the contractor who wants to set up permanently. The HOT ROD boasts many new features (a few are listed at the left). It has a minimum of removable parts for transport, a good bin capacity, and a choice of screen and mixer sizes. It's a plant that's extremely simple to operate and easy to service. The 5000-lb. batch capacity HOT ROD shown above has produced in excess of 200 T.P.H. at a highly consistent rate.

Before you buy any asphalt plant . . . get *all* the facts on the all-new MADSEN HOT ROD. Contact your local MADSEN Distributor, ask for Catalog No. 391. MADSEN WORKS, 14120 E. ROSECRANS AVE., P. O. BOX 38, LA MIRADA, CALIFORNIA.

Big New Features . .

MADSEN *Equipment that Serves*

- New fully-enclosed gear box reduction unit that goes right into the mixer shafts! . . . eliminates exposed mixer timing gears.
- Famous MADSEN Twin-Shaft Pug Mill Mixer (Patented) with externally removable sectional liners, improved mixing action and faster discharge.
- Simplest, cleanest design in the industry . . . with a minimum of removable parts for easy transport and fast set up.
- Exclusive bin design (Patent Pending) eliminates segregation.
- MADSEN Asphalt Pressure Injection System (Patented) with new rotating distribution bar . . . injects the asphalt into the mill quickly — cuts it off sharply — to give you improved mixing and reduced mixing time.
- Fast air operation of bin gates, asphalt pressure injection and mixer gate.
- Operator's station on end of plant . . . with swivel-head asphalt and aggregate scales and all controls conveniently located for easy, fatigue-lessening plant operation.

ASPHALT PAVING PLANTS • PUG MILL MIXERS • AGGREGATE DRYERS • DUST COLLECTOR UNITS
ROAD PUG TRAVEL-MIX PLANTS • WEIGH BATCHERS • SUPER FLOAT AND JOHNSON FLOAT FINISHERS
ASPHALT TANKS • ROYAL CROWN PUMP VALVES • ASPHALT AND FUEL PUMP UNITS

for more details circle 264, page 16

BALDWIN BLH LIMA-HAMILTON

MADSEN WORKS
CONSTRUCTION EQUIPMENT DIVISION
BALDWIN-LIMA-HAMILTON

DIVISIONS: Austin-Western • Eddystone • Electronics & Instrumentation • Hamilton • Lima • Loewy-Hydropress • Madsen • Pelton • Standard Steel Works

STANDARD MC-3 Cut Back Asphalt is applied to Boulder County Highway 10. Standard Asphalt engineer Oscar Jones (left) and Highway Superintendent Douglas N. Stewart check application.

Ordering STANDARD Asphalt

makes job easier for Boulder County Highway Department

As the link between Longmont and State Highway 66, Boulder County Highway 10 gets plenty of traffic. To take this traffic, road is surfaced with STANDARD Asphalt.

Boulder County Highway 10 in Colorado links the city of Longmont with State Highway 66 three and a half miles to the west. It is a popular highway for travel to Rocky Mountain National Park and for farm-to-city traffic. Maintenance of this highway in first class, all-weather condition is made easy by the use of STANDARD Asphalt. The Boulder County highway department gets these benefits from ordering asphalt requirements from Standard: (1) top quality product and (2) an assured source of supply.

And there are still more advantages to ordering asphalt from Standard Oil. Standard's experienced asphalt salesmen know the needs of road builders and are qualified to work with them in planning requirements. Standard Oil has long experience as an asphalt supplier, knows what it means to protect customers on supplies and deliveries.

You can get these advantages when you buy asphalt from Standard. Find out. Call your nearby Standard Oil Office in any of the 15 Midwest and Rocky Mountain states, or contact Standard Oil Company, 910 South Michigan Avenue, Chicago 80, Illinois.

STANDARD **STANDARD OIL COMPANY** (Indiana)

Highway 10 running west of Longmont, Colorado to State Highway 66 is 24 foot wide, asphalt surface, all weather highway. Standard Oil's Oscar Jones and Highway Superintendent Douglas N. Stewart inspect road recently resurfaced.

Comment By G. L. Oliensis

(Continued from page 172)

abstract claim that it does differentiate between the more homogeneous and less homogeneous asphalts, and that it is therefore a valuable identifying test, and an equally valuable laboratory tool for detecting any deviation in an asphalt's normal homogeneity through abnormal operations of whatever kind to which it might be subjected in the course of its refinery treatment.

However, additional years of study and research have indicated that homogeneity in a bitumen is a definite asset in itself and does promote the durability of the asphalt in most types of long-time service; and that therefore the Spot Test, far from being the "bogus" test that Mr. Nevitt has christened it, has a still higher degree of usefulness than had originally been suspected, and actually qualifies not only as an identifying test but as a true quality test. I am at present at work on a paper on the subject detailing the grounds upon which this new claim for the test is being based; but for the time being I hope those interested in maintaining quality in asphalts will not prejudge the case nor be prematurely influenced by the rather specious arguments that have been advanced against the Spot Test in its earlier years, and that are apparently being pressed with renewed vigor in the last year or two by those interested in being freed from its restrictions.

G. L. Oliensis
Summit, Illinois

Asphalt Institute starts advertising campaign

The Asphalt Institute, research and development center for the asphalt industry, launched a $600,000 national advertising program late in May with an initial two-page spread in LIFE magazine.

At the same time, agency executives at McCann-Erickson's Marschalk & Pratt Division have launched a campaign in leading engineering and trade publications, including ROADS AND STREETS. The campaign, first in the 36-year history of the Institute, extols the qualities of modern, heavy-duty asphalt pavements and will be tied to the theme: "Ribbons of Velvet Smoothness."

The financial community, whose interest in pavements is linked to highway bond flotations, will get the asphalt story through the columns of the *Wall Street Journal* and *U.S. News & World Report*.

Supporting this program of space advertising, the Institute will sponsor an all-summer weekend "Weather on the Highway" broadcast series over 200 CBS radio stations. These news and weather broadcasts will be spotted to catch the summer motorist at a time when he is directly conscious of pavement quality.

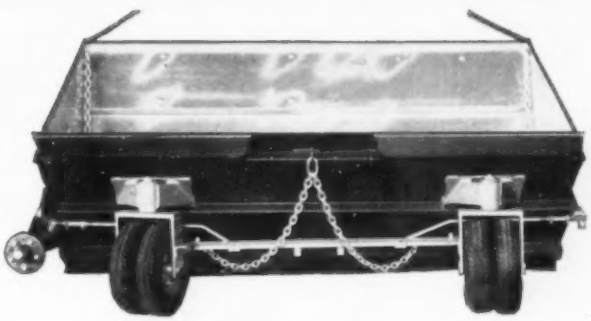
Poster advertising, pin-pointed in key cities all over the nation, will backstop the broader aspects of the program. A substantial segment of the total advertising budget has been reserved to each of the five geographical divisions of the Institute family. These funds will be allotted for local newspaper advertising where special developments indicate a need.

Plenty of asphalt, say Institute leaders

The state highway departments have been assured by The Asphalt Institute that ample stocks of asphalt will be available for all highway needs during the 1956 season. Institute officials were concerned with rumors of an impending asphalt shortage. These rumors, officials said, gathered momentum during the spring, particularly in some Midwestern states.

"A poll of asphalt producers by the Institute in December established the fact that refineries are prepared to meet any demands for asphalt this year," said J. E. Buchanan.

OVERMAN STONE AND BITUMINOUS SPREADER



IMPROVED . . . This all-purpose, low cost spreader is now equipped with pneumatic tires, providing easier steering and moveability, and eliminating vibration and road shocks when towing.

If this spreader is not part of your paving equipment, investigate at once. It's the most efficient, easiest operating paver available, and its low price will surprise you.

WRITE FOR BULLETIN TODAY

I. J. Overman Mfg. Co.
BOX 896 MARION, IND.

. . . for more details circle 272, page 16

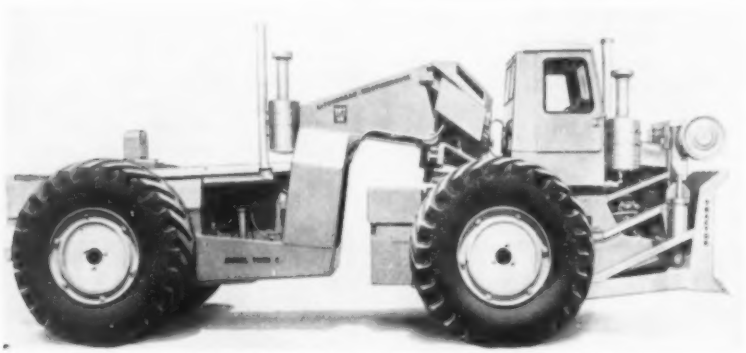
write for further information
Swenson Spreader & Mfg. Co.
Lindenwood, Illinois

Speed Sealcoating Jobs with SWENSON SPREADERS

. . . for more details circle 288, page 16

What's New
in Equipment and Materials

Readers Service Coupon on Page 16



Twin C Tractor Has 416 HP and Weighs More Than 40 Tons

416 HP, 81,000 lb. Tractor

A new two-engine tractor, having 416 hp, a weight of 81,524 lb., and capable of speeds up to 20 miles per hour, has been introduced by LeTourneau-Westinghouse Co., Peoria, Ill. Designated the Model Twin-C, the tractor is designed primarily to push load the larger self-propelled scrapers. Dynameter tests are stated to have shown that on a footing of sandy clay, the Twin-C weighing 81,524 lb., in first range, has recorded a drawbar pull of 65,900 lb.

A number of design features combine to give the tractor maximum pulling and pushing power from its synchronized twin diesels. Big 6 ft. high, 29.5x29 tires provide 2 ft. 5 in. wide ground gripping traction at each wheel to take advantage of the tractor's weight. Tires are hydro-flated and are equipped with wheel weights. All four wheels are drive wheels with equal weight distribution on each.

With speeds of 20 mph forward and 5.8 mph in reverse, the twin-C matches the pace of self-propelled scrapers, and can move fast in either direction. Instant response electric controls, exclusive with LeTourneau-Westinghouse, give the machine not only positive power steering but also power a unique floating push bowl.

This bowl, a pushing innovation, measures 4 ft. high and 7 ft. wide and incorporates a special spring loaded mounting which automatically smooths contact between tractor and scraper. Absorbing shock it prevents jolts from being transmitted along the frames of scraper or pusher. To take full advantage of the contact area of the scraper pushblock, the big bowl is quickly raised and lowered by instant response electric-control. Combined with the shock proof feature this allows the operator to "feel" the load to determine the best position of his pushbowl for a direct line push which will load the scraper quickly.

Dual engine power is completely synchronized with air and electric controls making the Twin-C extremely easy to operate. A touch of a single hand throttle operates air pressure controls which tune the engines to exact matched speeds. Moving a single lever on a conventional selector shifts both transmissions simultaneously. The big multiple-disc four-wheel air brakes are controlled by one easy operating pedal.

Articulated steering which allows all four wheels to apply maximum pushing or pulling power even in the tightest turns is controlled with a fingertip switch on the instrument panel.

Automatic power-transfer differentials on the Twin-C both front and rear, match pull to traction. In sand, mud, and loose materials, this exclusive design differential, instantly and automatically transfers the bulk of the power from the engines to the wheels with the best footing.

The Twin-C's power is supplied by two GM 6-71, 208 hp diesels. Transmissions are LeTourneau-Westinghouse air-actuated constant mesh units teamed with single stage torque converters.

For more information circle 123 on Service Coupon Page 16 and mail now.

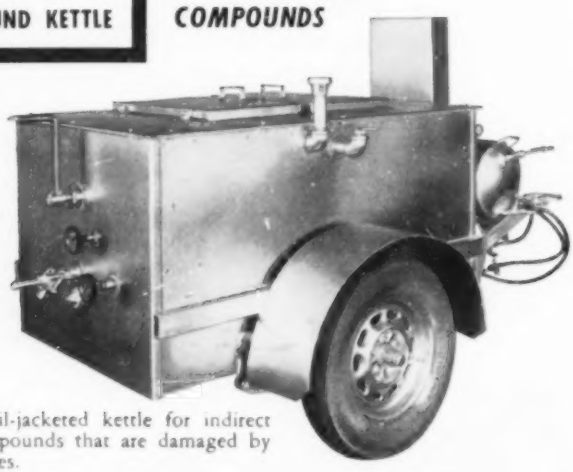
Paver-Spreader

A new low cost paving-spreading machine, Tru-Lay, announced by Littleford Bros., Inc., Box 75, 454 E. Pearl St., Cincinnati 2, O., is claimed to give compaction up to 80% of larger self-propelled pavers with mechanical tampers.

Patented balancing beam, compaction chamber, and adjustable hinged screed permit 75% of the unit's weight, plus the weight of material, to be placed on the screed. This weight of approximately 3 tons brought to bear directly on the compaction chamber and screed, is stated to produce a mat so firmly compact and

White
F-10 COMPOUND KETTLE

. . . FOR LOWER COST MELTING OF JOINT COMPOUNDS



TOP QUALITY, oil-jacketed kettle for indirect heating of compounds that are damaged by high temperatures.

FOOLPROOF manual burner adjustment.

LOW COST of $998 f.o.b. factory, complete with two thermometers (one for heating-jacket oil, one for compound), manual agitator, oil burner, steady rest, towing eye, tires. Engine agitator or propane heating available

CAPACITY: 120 gallons of compound

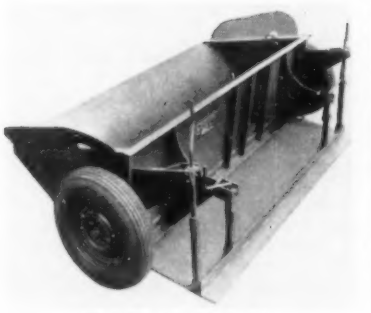
FOR LITERATURE, WRITE

OTHER PRODUCTS

Asphalt Plants, Tool Heaters, Surface Heaters, Torches and Burners

WHITE MANUFACTURING COMPANY, ELKHART 20, INDIANA

. . . for more details circle 306, page 16



Tru-Lay Paver-Spreader

smooth, rolling operations can begin almost immediately.

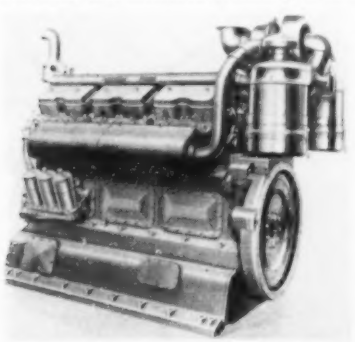
Outstanding features of the new paver-spreader are its pneumatic balancing wheels, chain-hitch attachment, and 16 in. hopper throat. Pneumatic tired wheels act as an outrigging, floating over low areas or flexing when encountering uneven grades. This feature is possible because the unit's weight is supported by screed. With unit empty and tongue inserted, wheels are used to easily transport machine from job to job. Chain-hitch arrangement eliminates truck sway. Chains fastened to front of Tru-Lay are crossed and simply attached to truck's front bumper. Using this arrangement any shock encountered by truck is not transmitted to unit.

Tru-Lay's extra large 16 in. wide hopper throat is stated to assure an even, smooth flow of dense material, tight mixes or stone base without bridging or choking-up. It is stated Tru-Lay paver-spreader lays up to 100 tons of material per hour in a smooth, even, level mat from 4 ft. to 8 ft. in width and up to 6 in. deep. Attachment increases mat size to 10 ft. An agitator model with independent gasoline engine drive is available and recommended when laying a 10 ft. wide mat.

For more information circle 124 on Service Coupon Page 16 and mail now.

Two Heavy-Duty V Type Engines

Two new heavy-duty V-type engines have been announced by Caterpillar Tractor Co., Peoria, Ill. Capable of producing up to 650 hp (maximum), the new units add increased versatility to the



Left Rear View of New 650 hp Turbocharged Cat D397 Diesel Engine

ROSCO'S P.M.*

makes the difference

***P. M.** = Pressure Metering

Applying bitumen through 2 feet of spraybar as shown may not appear unusual or different, but when the operator can use any length—from 1 to 24 feet—*without changing the pressure* and *without any application adjustment whatever* . . . then there's a difference. It's *Rosco's Pressure Metering Method* that makes that difference.

The P. M. method of applying bitumen is *not* metered by the bituminous pump, nor is the amount of discharge measured in relation to the pump revolutions. Normal wear of the pump and occasional, unavoidable nozzle clogging never affect the application rate. Here again, Pressure Metering *makes the difference* . . . the rate is automatically maintained by Rosco's P. M. system.

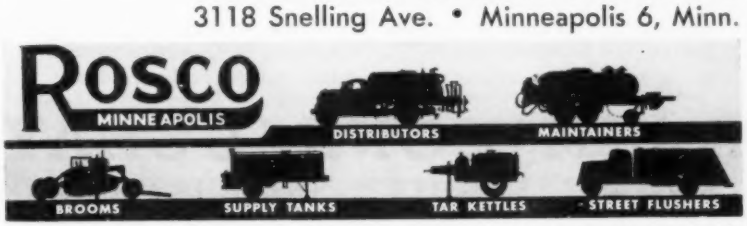
It is this Pressure Metering Master Valve, the "heart" of Rosco Distributors, that gives you this built-in control of pressure which is the only accurate method of obtaining precise bituminous application. This is the valve that also directs the flow of material for all of the Rosco Distributor functions.

Make the difference pay off. Let your Rosco dealer show you how. Write the factory for descriptive bulletins with specifications of Distributors with P. M.

•

ROSCO MANUFACTURING CO.

3118 Snelling Ave. • Minneapolis 6, Minn.



. . . for more details circle 279, page 16

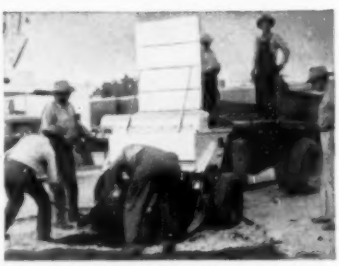
NEW *McConnaughay*
MULTI-PUG ASPHALT MIXER

REMOVES BOTH MOISTURE AND SOLVENTS

MODEL HTD-500

Prepares Hot or Cold Bituminous Mixtures—¼ *Ton Capacity*

Designed for economy of operation in the production of bituminous paving mixtures, this new McConnaughay HTD-500 Mixer is large enough (¼ ton capacity) for many resurfacing jobs as well as all types of pavement patching. Working on location, it provides the exact amount of material needed; never too much or too little. It has a low pressure burner directed into the mixing and heating unit through a combustion chamber. This HTD-500 and all McConnaughay HTD models are *the only mixers which effectively remove both moisture and solvents from bituminous mixtures* . . . giving you positive assurance that patches and resurfaced areas will set up hard as soon as the applied mixture cools. Write, wire or 'phone for details and specifications today.



McConnaughay HTD-500 at work on street patching job in Cheyenne, Wyoming.

K. E. McCONNAUGHAY
LAFAYETTE 2, INDIANA

. . . for more details circle 261, page 16

company's line of modern industrial engines.

Available in turbocharged, roots-blown, naturally aspirated and spark plug ignited versions, the new 8 and 12 cylinder D375 (Series D) and D397 (Series D) engines are of 4-cycle design, as were their predecessors, the D364, D375, D386 and D397.

Principal differences between the new engines and the former models are in the cylinder heads, exhaust manifolds, method supercharging, and in the case of the spark-ignited engines, the fuel used and the method of igniting it. Inherent advantages of the former models, such as the completely water-jacketed, port-free cylinder liners and the low injection pressure, pre-combustion chamber type fuel injection system have been retained.

The new turbochargers now available for these engines enable them to produce increased power with less fuel by using the energy of exhaust gases which would otherwise be wasted. New exhaust manifolds are offered in "dry," "shielded" and "wet" versions to enable users to adapt the engines to their specific needs.

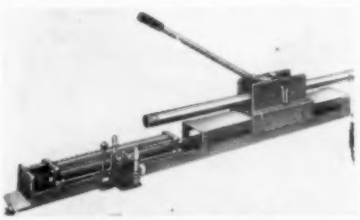
The new D397 and D375 spark ignited engines produce 400 and 267 HP respectively, using low cost natural gas as fuel. Outstanding features are a 10 to 1 compression ratio, a low-tension magneto ignition system and new "deep-domed" pistons. The new ignition system uses a magneto to feed low tension current to high tension transformers located near the spark plugs. This keeps the high tension leads very short for a hot, positive spark.

The "deep-domed" pistons used in the new spark-ignited engines are the result of extensive research and engineering. They have been designed to give smooth, efficient combustion over a wide range of operating conditions. Carburetors for the new engines are of the heavy-duty industrial type.

For more information circle 125 on Service Coupon Page 16 and mail now.

Powered Pipe Pusher

A completely powered continuous 21 in. stroke pipe pusher, announced by Mercury Hydraulics, Inc., 2440 Blake St., Denver 5, Colo., is designed for lower cost and fastest underground pipe installation. It is claimed that performance records of 75 ft., in 18-20 minutes on 2 in. pipe through hard compaction and distance pushes up to 186 ft. have been made.



"Speed-Thru" Pipe Pusher

Simple operation of two controls,

pushes pipe in continuous 21 in. thrusts. Hydraulic power is furnished by gas engine, DC truck power or AC electric power units as desired. Two 25 ft. hydraulic pressure and return hoses, equipped with quick couplers, expedite setting.

By reversing the forward pushing principal, the pusher will pull pipe as rapidly as it pushes. It is not necessary to turn the machine or adjust power or speed for pulling operations.

For more information circle 126 on Service Coupon Page 16 and mail now.

Go — Anywhere Tires

The Terra-Tire, a barrel-shaped, low-pressure pneumatic tire that can be powered through its axle by any conventional drive system, has been announced by the Aviation Products Division of the Goodyear Tire & Rubber Co., Akron 16, O. It is stated this tire

Terra-Tires on Dodge Power Wagon

can take trucks, trailers and other off-the-road vehicles over all types of terrain and roadways. Speeds up to 65 miles per hour have been achieved.

Through a hub and axle fitting, the tire receives its motive power directly from the engine. This tie-in with conventional drive systems is stated to mean a considerable savings in weight, mechanical complication and cost.

Developed by Goodyear for use by the Transportation Corps., it is stated Terra-Tires can go where conventional tires "fear to tread," because of a low pressure inflation of between 3 and 5 lb. The soft pneumatics tend to swallow up rough, uneven surfaces with little risk of puncture or blowout by conforming with uneven surfaces instead of resisting them. The tires act as built-in shock absorbers.

For more information circle 127 on Service Coupon Page 16 and mail now.

Tandem-Axle, 6-Wheel Trucks

A completely new line of tandem-axle, 6-wheel trucks ranging from 31,000 to 46,000 lb., maximum gross vehicle weight and up to 65,000 lb., maximum gross combination weight, introduced by Dodge Division, Chrysler Corporation, Detroit, Mich., were designed for maximum flexibility and traction in rough off-highway operations. New V-8 engines ranging up to 220 hp power this new line.

New Tandem-Axle 6-Wheel Truck

The new KX model is powered by a 201 hp V-8 engine with 331 cu. in., displacement. It is offered in wheelbases of 141, 153, 171 and 189 in. It has a maximum gross vehicle weight rating of 31,000 lb., and a maximum gross combination weight rating of 45,000 lb. The rear axle bogie capacity is 22,000 lb., with 28,000 lb., offered as extra equipment.

The new TX model is powered by a 212 hp V-8 engine. This 331 cu. in. displacement engine has twin carburetion. The model is offered in wheelbases of 144, 156, 174 and 192 in. It has a maximum gross vehicle weight rating of 36,000 lb., and a maximum gross combination weight rating of 55,000 lb. The rear axle bogie capacity is 28,000 lb.

The new YX model is powered by a 220 hp V-8 engine with 354 cu. in. displacement. It is offered in wheelbases of 144, 156, 174 and 192 in. It has a maximum gross vehicle weight rating of 46,000 lb., and a maximum gross combination weight rating of 65,000 lb. The rear axle bogie capacity is 34,000 lb., with 38,000 lb., offered as extra equipment.

The new tandems are offered with 5-

Standard Steel

MODEL 55 *Tandem Roller*

1½ to 2½ TONS

for ECONOMY... SPEED

BUILT LIKE THE BIG ONES

PERFORMS LIKE THE BIG ONES

Provides FLUSH CURB Rolling on Each Side

THE MODEL 55 ROLLER was designed to provide two important advantages: (1) Adequate compaction for patch rolling requirements and (2) Ideal roll dimensions for smoothing and finishing work. Ballasting is evenly distributed through the use of both steel and water ballast. Steel ballast is removable in 70# sections providing a wide choice of compaction ranges.

The Model 55 will roll to within 2 inches of wall or building on driver's side and to 4½ inches on opposite side. Eight inch ground clearance provides flush rolling adjacent to curbings. Automotive steering makes easy driving. Upholstered seat, safety seat rail, speed control, throttle and foot brake are of motor-car type — and water valve is in easy reach of operator. The maximum weight with all ballast is 4600#. Shipping weight is 3600#. Speed — from 1.75 MPH to 3.5 MPH

TRAILERIZED FOR EASY TRAVEL FROM JOB TO JOB

Photo above shows ease with which roller is loaded and unloaded from trailer. One man can easily lift and hook it to towing vehicle

Loading Ramp becomes end gate. Roller locks on trailer for safe travel at all speeds. Write for FREE Catalog and Prices

Built to the Highest Standard

R-1

Standard Steel Works, Inc. NORTH KANSAS CITY MO

. . . for more details circle 287, page 16

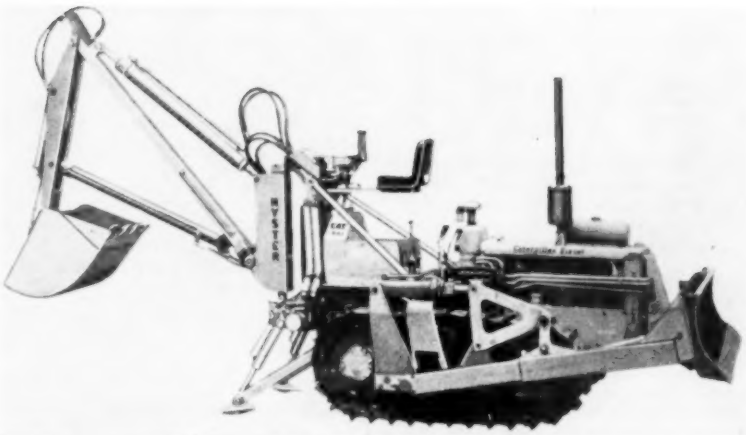
speed transmissions as standard equipment. Available as factory installed extra equipment is a complete line of 3-speed auxiliary transmissions.

For more information circle 128 on Service Coupon Page 16 and mail now.

Tractor-Mounted Hydraulic Backhoe

The new hydraulic D4 backhoe of ½ yd. capacity announced by Hyster Co., 2902 N. E. Clackamas St., Portland 8, Ore., is designed for the Caterpillar D4 tractor.

The backhoe has full track-type tractor mobility, is capable of digging down to 13 ft. and loading up to a height of 9 ft., 7½ in. A rack and gear swing mechanism, operating in an oil-tight



Hyster Hydraulic D4 Backhoe Attachment

case, provides swing power at uniform speed throughout a full 240 degree arc.

For ease in negotiating rough terrain, the backhoe incorporates an equalizer which allows full track oscillation. The equalizer may be locked to obtain rigid-tractor stability. Retractable hydraulic outriggers provide full machine stability. Convenient controls make possible easy, fast operation and full visibility is provided for the high, comfortable operator's seat.

Dippers for the new D4 backhoe are available in cutting widths of 13, 21 or 29 in. They are equipped with Esco replaceable alloy steel points crimped onto adapters from the bottom for easy replacement.

For more information circle 129 on Service Coupon Page 16 and mail now.

Diesel Truck Exhaust Brake

A new exhaust brake announced today by Mack Trucks, Inc., New York 1, N. Y., is claimed to increase engine retardation by more than 50 percent to add to diesel truck safety and to reduce wear on brakes.

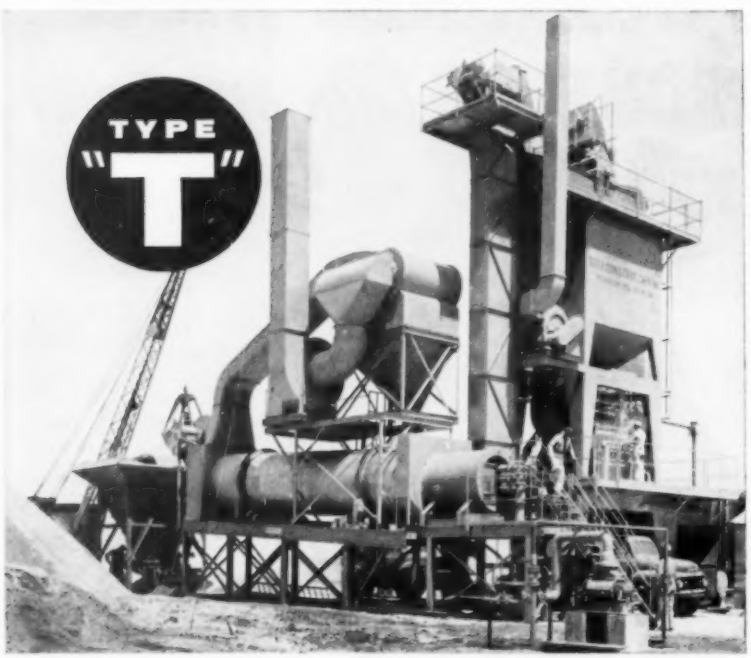
By means of a simple butterfly valve in the exhaust line, back pressure is created to transform the engine to an air compressor, thus augmenting full engine braking which long has been a Mack feature.

An electro-pneumatic control system enables the new exhaust brake to assist the conventional braking system in slowing down or bringing the vehicle to a stop or in retarding speed on downgrades.

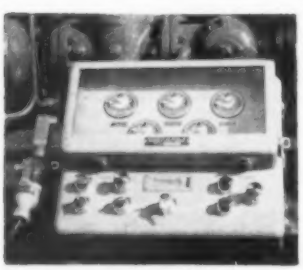
The new exhaust brake is under the driver's control constantly. A simple three-position switch permits the exhaust brake to actuate automatically whenever the brakes are applied, to respond when the accelerator is released or to be cut out of action entirely.

Power to operate the butterfly valve is supplied by an air cylinder connected with the regular airbrake system, a magnet valve controlling the admission and exhaust of air.

For more information circle 130 on Service Coupon Page 16 and mail now.



Now Available With Automatic Cycle Control



Automatic Cycle Control—now on all H & B Type "T" and Mobile asphalt plants.

H & B Type "T" batch type asphalt plants, also the new Mobile completely portable batch plants, are all now equipped with automatic cycle control. This equipment provides for automatic control of the entire mixing cycle, with no loss of time between runs. The operation, however, is still fully under control of the operator, and may be interrupted at any time or operated manually in the conventional manner.

Automatic weighing is also available—as optional equipment—on both Type "T" and Mobile plants — in connection with the Fluidometer system and Automatic Cycle Control to make the entire mixer floor operation automatic.

Complete information about Automatic Cycle Control and completely automatic mixing and batching will be sent on request.

HETHERINGTON & BERNER INC. • ***Engineers . . . Manufacturers***
741 KENTUCKY AVENUE **INDIANAPOLIS 7, INDIANA**
. . . for more details circle 237, page 16

Manufacturers' Literature

Automation in Asphalt Plants

"Automation in Asphalt Plants" is the title of a new bulletin (No. AA-56) issued by Hetherington & Berner Inc., 701 Kentucky Ave., Indianapolis 7, Ind. The bulletin describes the automatic cycle control which is now furnished on H & B batch type asphalt plants. This equipment provides for automatic control of the entire mixing cycle, with no loss of time between runs. Automatic weighing is also available on H & B plants as optional equipment, in connection with the automatic cycle control and the Fluidometer automatic metering system, which has been a feature of H & B plants for many years. This combination makes the entire mixer floor operation automatic. The outstanding feature of the Fluidometer system is that it resets itself automatically, thereby not only eliminating the human element with its possibility of error, but also assuring an accuracy to within a small fraction of 1% by actual weighing and checking.

For more information circle 131 on Service Coupon Page 16 and mail now.

Surface Seal for Asphalt Pavements

A new 4-page catalog (Form LL-2992) describing Jennite J-16, surface seal for asphalt pavements, has been announced by Maintenance Inc., Wooster, O. The profusely-illustrated folder lists the major causes of asphalt deterioration and explains how they can be stopped with Jennite. It also discusses application methods, application engineering service, cost and shipping information.

For more information circle 132 on Service Coupon Page 16 and mail now.

Tar-Rubber Mix for Airfield Pavements

The use of synthetic rubber, blended with tar, to protect airfield pavements from the deteriorating effects of jet fuel spillage is described in a new eight-page booklet published by the Naugatuck Chemical division, United States Rubber Co. The illustrated booklet gives specifications of the tar-rubber mix. It can be obtained by writing to the Lotol and Latex Sales Department, Naugatuck Chemical division, United States Rubber Co., Naugatuck, Conn.

For more information circle 133 on Service Coupon Page 16 and mail now.

Turnpike and Expressway Lighting

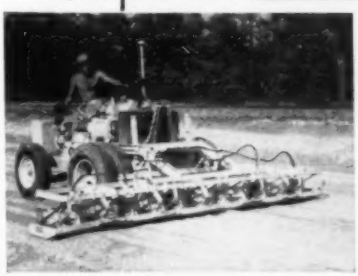
A new 28-page bulletin dealing exclusively with the lighting of turnpikes and expressways is available from the General Electric Co., Schenectady 5, N. Y. The publication, designated GED-3001, devotes special attention in sep-

4200 TWO-TON BLOWS PER MINUTE!

Here's TREMENDOUS COMPACTION

. . . for rapidly and most economically achieving or exceeding specified densities in the consolidation of rock, slag, gravel and sand base courses in waterbound and penetration macadam construction. The Jackson does it in just about half the time required with equipment of other types and is equally efficient in filling all the voids from top to bottom of rock and slag courses when sufficient fines have been spread.

Exceptional ON-THE-JOB ADAPTABILITY!



Above: a Jackson Multiple (6 units) on 7 mile sub-grade. Below: 2 units equipped with operating handle, self-propelling and easily operated by one man.

Standard width of the Jackson Multiple is 13', 3"; working speeds: up to 60' per minute; reverse: up to 5 MPH. Working width can readily be altered on the job to exactly suit narrower requirements such as widening projects. As many of the 6 compacting units as desired can be subtracted from the workhead, quickly and easily. Furthermore, easily interchangeable bases from 12" to 26" are available and individual compacting units may be fitted with operating handles and used exactly like the standard, highly popular, self-propelling manually guided Jackson Compactor. As a consequence Jackson equipment can be used on a great deal of work other machines cannot reach. If you have any job requiring compaction of granular soil, it will pay you to know specifically what Jackson Vibratory equipment will do. See your Jackson distributor. Literature and name of nearest Distributor on request.

JACKSON VIBRATORS, INC. LUDINGTON, MICH.

. . . for more details circle 246, page 16

Build Better Roads Faster at Lower Cost

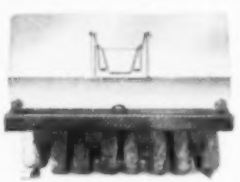
DUO-PACTION by SEAMAN-GUNNISON

DUO-PACTION builds *better* roads through more uniform, more firmly consolidated roadbed aggregates without change of grade or surface level. You build *faster* because you can get greater coverage, with fewer passes, in less time than with conventional methods.

DUO-PACTOR steel and rubber rolls, operating alternately or together, produce aggregate base of higher density and greater stability than with either pneumatic or steel alone.

Pneumatics *down*, steel *up* for conventional rubber rolling. Large diameter front drive rolls are non-tracking with rear rolls . . . no increase in depth of grooves.

Pneumatics *up*, steel roll *down*, flattens out the ridges without disturbing aggregate base. No need for another roller.



Torsion spring deflection of gang roll provides higher loading on ridges, leveling out compacted surface.

***Swing-Bar* DISTRIBUTOR**

Positive rate of bitumen application . . . no lean spots at starting line; no dripping after shut-off provided by quick-opening and closing *exclusive* Air-Snap spray bar.

SEAMAN-GUNNISON CORPORATION
Baraboo, Wisconsin
Send full information on:
☐ Duo-Pactor ☐ Distributor
Name .....
Address .....

. . . for more details circle 282, page 16

arate sections to the lighting of toll plazas, interchanges, service areas, main traffic lanes, bridges and viaducts, tunnels and underpasses, and special purpose lighting. A number of application diagrams are included to show the types and spacing of luminaires proven most effective in actual use. Fluorescent, mercury, and filament luminaires are discussed. The bulletin lists a number of recommendations for lighting hazardous areas on modern, high-speed turnpikes and expressways. The recommendations offered by G-E lighting experts are based on more than 30 years of working closely with local, state, and federal officials in lighting many of the country's limited-access roadways. Sections dealing with fundamental aspects of roadway lighting and fundamental design objectives are included along with three full pages of lighting reference data dealing in lay terms with the technical aspects of the problem.

For more information circle 134 on Service Coupon Page 16 and mail now.

Skid-Shovel

Versatility of the International Drott Skid-Shovel is shown in a new eight-page, 2-color mailing folder now available. Featured are the Skid-Shovel's five chief advantages, listed as the "pry-over-shoe" breakout, skid-shoe action, description of its depth-gauge indicator for straight-forward loading, parallelogram raise action, and the shock-swallowing protection of its patented hydrospring. Also described are the use of a variety of attachments, among them the rock fork, bullangledozer blade, log and pulpwood rack, combination rack, scarifier, grubber blade, and buckets. Ask for booklet CR-407-F, Consumer Relations Department, International Harvester Co., 180 North Michigan Ave., Chicago 1, Ill.

For more information circle 135 on Service Coupon Page 16 and mail now.

Wheel Tractors

The new 445 utility wheelers of Minneapolis-Moline, Minneapolis 1, Minn., is illustrated and described in a 6-page folder. This tractor is adapted for many attachments such as front end loaders, back hoe, blade, trencher, scarifier, post hole digger and post driver. The 445 has a brake horsepower of 51. Specifications are included in the folder as well as illustrations and descriptions of the important features of the tractor.

For more information circle 136 on Service Coupon Page 16 and mail now.

Contractors and Mining Equipment

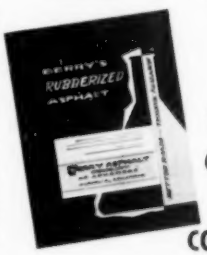
A new No. 44 catalog, second edition, announced by Thor Power Tool Co., Aurora, Ill., lists the company's complete line of mining and contractors' equipment. The 68-page book is printed in two colors throughout, permitting showing of many Thor tools in the actual color of the unit when it is delivered to the user. Complete specifications and information are given on a number of tools Thor has introduced since the first edition of this catalog. These include the SW-1 and BW-5 wagon drills, 15 utility hammer, 16M clay digger, 37 and 77 sinker rock drills, 82CB crust breaker, 390 push-feed drill, 680 leg, 5V air grinder, 80 impact wrench on raiser leg, and 56 electric speedwrench. A typical page of the catalog shows a photograph of a basic Thor tool, in color, super-imposed on a picture of an actual job with the tool in use. In addition to complete descriptive matter on the tool and its related models, a specification table is carried together with information on repair kits and other salient facts. Full listing occurs on attachments, accessories and replacement parts available with all tools.

For more information circle 137 on Service Coupon Page 16 and mail now.

Mechanical Features of Diesel Crawler Tractors

Mechanical features of the complete line of new International Diesel crawler tractors are contained in a 6-page, 2-color mailing folder now available. Described are the International TD-24, TD-18, TD-14, TD-9, and TD-6 models, along with photographs of the machines on the job and close-ups of outstanding features, such as the new Cerametallic clutch facings, improved operator visibility, push-button starting, 500-hour track roller seals, pressurized cooling system, easier steering operation and extra-strength track frames. Increase horse-

BERRY'S *RUBBERIZED* ASPHALT



THIS FOLDER CAN SAVE YOU THOUSANDS OF DOLLARS IN ROAD CONSTRUCTION AND MAINTENANCE

YOU WILL SEE HOW rubber and asphalt have been successfully blended to form an all weather sealcoat — how the adhesiveness and resiliency of rubber have been retained in the exclusive Berry blending process — why Berry's rubberized asphalt is less susceptible to temperature, holds more aggregate, saves on bitumen and requires far less maintenance.

Write for your copy today.

BERRY ASPHALT COMPANY OF ARKANSAS
P. O. Box 800 Magnolia, Arkansas
MEMBER OF THE ASPHALT INSTITUTE

. . . for more details circle 190, page 16

"LUBRIPLATE, THE OUNCE OF PREVENTION"

says
VULCAN IRON WORKS, INC.
of Chicago, Ill.

—a leading manufacturer of pile driving and extracting equipment

"For many years we have used LUBRIPLATE Lubricants for shop assembly, and have recommended them to our customers through your LUBRIPLATE Tag Plan. Our experience shows that if the proper lubricants are used from the beginning, there are fewer problems and parts replacements later. We consider LUBRIPLATE to be the best possible ounce of prevention."—
H. G. Warrington, Vice-Pres.

REGARDLESS OF THE SIZE AND TYPE OF YOUR MACHINERY, LUBRIPLATE LUBRICANTS WILL IMPROVE ITS OPERATION AND REDUCE MAINTENANCE

LUBRIPLATE LUBRICATION

MAKES CARS AND TRUCKS RUN BETTER AND LAST LONGER

LUBRIPLATE H.D.S. MOTOR OIL . . . THE OIL THAT NEEDS NO ADDITIVES

For nearest LUBRIPLATE distributor see Classified Telephone Directory. Send for free "LUBRIPLATE DATA BOOK" . . . a valuable treatise on lubrication. Write LUBRIPLATE DIVISION, Fiske Brothers Refining Co., Newark 5, N. J. or Toledo 5, Ohio.

. . . for more details circle 259, page 16

power of the TD-9 and TD-6 also are detailed. Ask for booklet CR-553-F, Consumer Relations Department, International Harvester Co., 180 N. Michigan Ave., Chicago 1, Ill.

For more information circle 138 on Service Coupon Page 16 and mail now.

Specification Data for Traffic Paint

Specification data covering traffic and maintenance paints are given in the new "Specification Guide" issued by The Sherwin-Williams Co., Cleveland 1, O. Traffic marking paint specifications listed take into consideration the standards of the American Society for Testing Materials. The specifications for maintenance finishes are based on Sherwin-Williams' research and experience in developing such materials. The data presented cover both white and yellow, reflectorized and non-reflectorized traffic paints. In addition, there are recommended specifications for rust-inhibiting metal primers, exterior enamels for metal, exterior ready-mixed aluminum paints, park bench finishes and guard rail paints.

For more information circle 139 on Service Coupon Page 16 and mail now.

Steel Platform Bodies

A new 2-page, 2 color catalog, (LL-2945) descriptive of the Galion line of steel platform bodies, is available from Galion Allsteel Body Co., Galion, O. Containing both action and detail photos, the new catalog describes and illustrates Models 4N-3, 4N-4 and 4N-5 12 to 16 ft. platform bodies. Construction details, capacities, sizes and condensed specifications are included. Recommended matching hoists are also listed.

For more information circle 140 on Service Coupon Page 16 and mail now.

Truck Operators Handbook

A 64-page illustrated handbook on highway and off-the-road tires has been published by B. F. Goodrich Tire and Equipment Co., Akron, O., and is available to truck operators without charge.

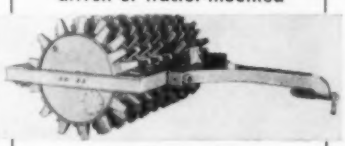
The handbook includes a tire selection chart and load and inflation tables for tires in highway, earthmoving, mining, logging and road grader service. Eighteen pages are devoted to a discussion of tire care, covering such subjects as inflation, a formula for analyzing loads, effect of heat, mechanical irregularities, matching of duals, spacing of duals, rotation, rims and storage. A special section on the care of off-the-road tires suggests ways to improve operating conditions and offers driving tips which extend the life of tires in such service. Facts about tubeless truck tires and nylon construction, as well as data on the company's complete line of highway and off-the-road tires, are also included in the handbook.

For more information circle 141 on Service Coupon Page 16 and mail now.

(Continued on page 210)

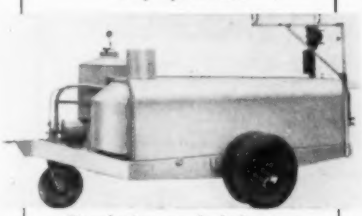
Grace ASPHALT AND COMPACTION EQUIPMENT

Roadsweepers, traction, engine-driven or tractor-mounted

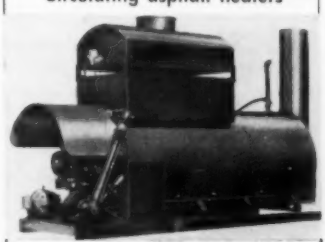


Sheepsfoot rollers

Chip spreaders



Circulating asphalt heaters



Automatic oil heaters for hot plants

Pneumatic rollers, self-propelled or trailed

W. E. GRACE MFG. CO.

. . . for more details circle 230, page 16

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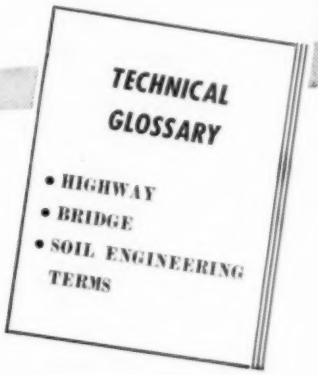

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The need of a specific glossary or dictionary of terms of this type has long been felt. After several International conferences between representatives of the U. S. Bureau of Public Roads and Latin American engineers, a decision was reached to prepare such a glossary. To further extend its usefulness, soil stabilization and associated laboratory work was included.

The manuscript for this book of over 35,000 terms was over 15 years in preparation under E. W. James, then Chief, Inter-American Regional Office, U. S. Bureau of Public Roads, working with the Library of Congress of the United States. It has been approved by a committee of five bilingual engineers of the Mexican government under the chairmanship of Sr. Ing. J. Fco. Rodríguez Cabo. It was then submitted to and approved by the "Academia Mexicana Correspondiente de la Academia Real Española" under the chairmanship of Sr. Don Martín Luis Guzmán, distinguished author, editor and publicist, also publisher of "El Tiempo."

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1—Blaw-Knox 200-gallon per minute automatic water weigh batcher.

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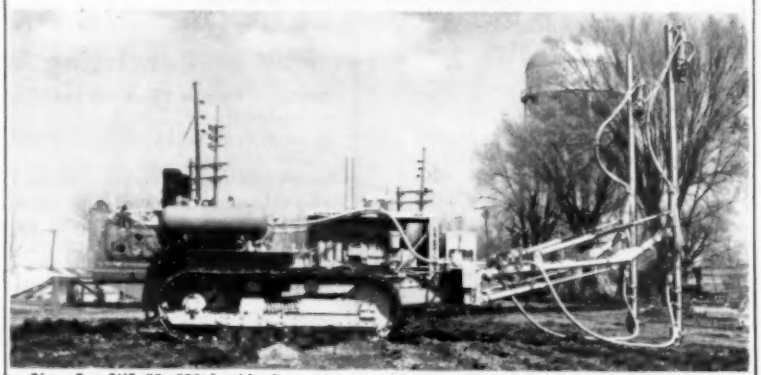

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1 40-foot conveyor with 30-inch belts and bulldozer hopper. Double deck vibrating screen. This conveyor driven by new Dodge truck motor.

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1949 GMC Tractor with Saddle Tanks.
1953 GMC 6-yd. Dump Truck with 2-speed rear axle.
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70 cu. ft. Smith Air Compressor, 4" Diaphragm Pump and 4" Centrifugal Pump.

Cleveland Subgrader complete with scarifying teeth for 8'6" to 13'6" road width.

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Attention: J. B. Benjamin
2041 Fenkell Ave. — Ph. UNiversity 2-3413
DETROIT 38, MICHIGAN

FOR SALE

5—TS-300 AC Scrapers, 275 H.P. Cummins.

1—HD-19 AC Tractor, 11 ft. GW Bulldozer.

1—621-S Page Dragline, 125 ft. Boom, 7 Yd. Bucket.

REID-HOLCOMB CO., INC.
1817 Kentucky Avenue
Indianapolis 21, Indiana
Phone Day & Night:
MElrose 2-4433

FOR SALE

3—White diesel tandem dump trucks with Cummins Diesel rear axle Model 4600. Power steering, 11/24 tires, 14 cu. yd. water level bodies with Gar Wood telescopic hoists.

2—Model 12 Caterpillar tandem diesel graders.

2—TD-24 diesel crawler tractors with blades.

1—Bay City Model 35 backhoe with Cat. diesel.

2—450 Bay City erector cranes with backhoe attachment.

1—Bay City Model 700 erector crane with Cummins Diesel and 1½ yd. backhoe attachment.

FRANK STAMATO & CO.
284 Main Street
LODI, NEW JERSEY
Phone: GRegory 3-7622

CLEARANCE SALE

1—Austin Western model 99M grader. Condition good $4,000
1—Pitman model B Hydralift mounted on White Truck. Cond. good..... 2,800
1—Ford tractor with backhoe and front end loader. Condition good..... 3,800
2—K-12 Insley backhoes, Chrysler 8 Industrial engines. Cond. good.....
1—K-12 Insley with Cat. 311 diesel engine. Special 3,500
1—K-12 Insley with GM diesel.....
1—Shovel front for Lima 34 Paymaster. 1,500
1—Ingersoll Rand 105 compressor, skid mount 750
1—Schramm 210 compressor 1,350
1—Schramm 210 compressor, Condition excellent 1,500

Complete line of air compressor and air tools. Rentals 60 to 600 C.F.M.

CLEVELAND CONTRACTORS EQUIPMENT CO.
10904 Brookpark Rd. SHadyside 1-5570
CLEVELAND 30, OHIO

MACK DIESELS

FOR IMMEDIATE SALE AND DELIVERY

Engines 18 Mos. Old — All Have Been Maintained by Cummins
All Have Good Tires

● 1951 Model A50 Macks, 149" W.B., Cab. JBS 600 — 150 H.P. Cummins diesel engine, 10 Sp. duplex trans., dual shift levers, direct and over, single reduction. 7.2 to 1 ratio, 12 volt, heaters, air horns, directional lights, luberfiner, 125 gal. saddle tanks, 5th wheel, W. Coast Mirrors, air brakes, hand valve and Semi Conn. 10.00x20 tires, 12 ply, vertical stack, crusing speed 55 M.P.H. Price Each **$2825**

● Same specification as above with Hendrickson trailing axle and 60 gal. step tanks. Price Each **$3225**

● 1945 Model LF471 Macks, 172" W.B. Cab, sleeperette, HRB 600 — 180 H.P. Cummins engine, 10 Sp. duplex transmission, single reduction rear axle, 12 volt, dual 60 gal. tanks, 5th wheel, directional lights, luberfiner air brakes, hand valve and semi-conn. Hendrickson trailing axle, vertical stack, 11.00x22 tires, 12 ply. Price Each **$2775**

● 1946 Model LF471, 149" W.B. Same specifications as above except sleeperette and trailing axle. Price Each **$2575**

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INTERNATIONAL TRUCKS

1608 Charlotte St. Kansas City, Mo. Ph. Grand 1-5844

FOR SALE

1—112 Caterpillar Motor Grader, Ser. #3U-3565, excellent shape.
1—212 Caterpillar Motor Grader, good condition.
1—Hough Payloader HMD, completely rebuilt.
1—Hough Payloader, HR, excellent shape.
1—BD3 Allis-Chalmers Motor Grader, good condition.
1—BD2 Allis-Chalmers Motor Grader, good condition.
2—Model "D" Allis-Chalmers Motor Grader, completely rebuilt.
5—99H Austin-Western Motor Graders, completely rebuilt.
1—88H Austin-Western Motor Grader, completely rebuilt.

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JACKSON, MISSISSIPPI
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All types of heavy work tires. Excellent condition.

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900-16 Heavy Duty Army Tread, Perfect	12.95
900-20 Perfect Combat Tires (Equal to 20-Ply)	35.00
1100-20 Heavy Duty Good Condition	35.00
1100-22 Heavy Duty Good Condition	25.00
825-20 Heavy Duty Good Condition	20.00
550-8 6-Ply Perfect Take-Off (Pneumatic Industrial Tires) ea.	4.95

Write for prices and sizes not listed. Send check or money order or 25%, balance C.O.D. Freight Collect.

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750-20 8-ply Army Surplus Full Tread

19.95

Terrific Value Perfect Casings

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Industrial Brownhoist Model 8, 35 ton diesel Locomotive Crane w/60' boom, air brakes, magnet generator, magnet controller. Serial 1189 in A-1 condition. Priced for quick sale.

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19615 Nottingham Rd.
Cleveland 10, Ohio

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1—LS-75 Shovel Front, H.D. Mang. Bucket ¾ yd.
1—H. Duty Hayward Rock and Log Grapple
1—2 Comp. CIMCO Batchbin with Scales
1—Foley Saw Filing Machine
1—Foley Power Retoother
All of the above like new.
1—Wisconsin AC4 Power Unit, Rebuilt
1—10 S Rex Mixer, Pneu. Tires, Good Condition
1—Getman Scottcrete, Excellent Condition
1—Single Drum Sheepsfoot Roller, Good Condition
1—Model G.T. Portable Herman N. Heater

Write P.O. Box 946
RADFORD, VIRGINIA
Wilson Construction Corp.

FOR SALE

1—Lima 802 Shovel
2—29-T Bucyrus-Erie Drills.
2—Super-C Tournadozers
1—4-yd. Hendrix Drag Bucket

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Highway 100 at Cedar Lake Rd.
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Highest dollar value paid for new and used trucks and all kinds of used equipment. All types of truck equipment bought and sold, including war surplus. Write, phone or wire:

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Phone: LEhigh 1-6020

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Christian 2D Hoist & Swinger, 138 HP Buda Diesel Engine. 15,000# SLP.
2 100 HP Lucey Portable Horiz. Fire-Box Boilers. 200 lbs. Oil Fired. ASME.
25 ton American Steel Guy Derrick.
30 Ton Steel Stiffleg Derrick 125' bm.
25 ton Ohio Diesel Loco. Crane 1947.
1½ yd. Northwest No. 6 Diesel Crane 1948.
1½ yd. Bucyrus-Erie 38-B Diesel Crane 1948.
¾ yd. Manitowoc 4500 Shovel-Dragline.
75 KW Cat. Diesel Generator 3/60/440.

Mississippi Valley Equipment Co.
515 Locust St.
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TANDEM DRIVE TRUCKS

1955 International RF195 air brake tractors. 450" motors, Roadranger transmissions, 1000-/20 tires. Ideal dumps, concrete mixers. Immediately available in quantities to 40.

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EUCLID REAR DUMP
TRUCKS, 15, 22 & 35 Ton
BUCYRUS-ERIE Draglines, 2½ yd to 13 yd.
BUCYRUS-ERIE Shovels, ¾ yd to 8 yd.
NORTHWEST Draglines, ¾ yd. to 2½ yd.
NORTHWEST Shovels, ¾ yd. to 2½ yd.
MANITOWOC Draglines, 2½ yd. to 5 yd.
MANITOWOC Shovels, 2½ yd. to 5 yd.
MARION Shovels & drags, 1½ yd. to 8 yd.
LIMA Shovels & Drags, 1½ yd. to 6 yd.
OSGOOD Shovels & Drags, 1½ yd. to 2½ yd.
PAGE Draglines, 5 yd. to 8 yd.
CATERPILLAR Graders & Dozers
HI-LIFT Shovels
2400 LIMA SHOVEL FRONT attachment
4500 MANITOWOC SHOVEL FRONT attachment
6" and 9" Drills, Diesel & Electric

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Construction Equipment
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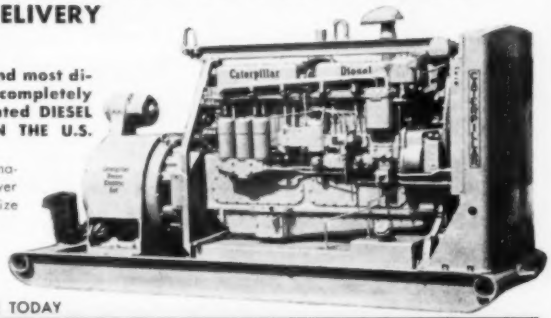

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8015 South Alameda Street • Los Angeles 1, California
Telephone: LUdlow 3-1696 Cable Address: "PAREQUIP"

FOR SALE

1—Model 900 — 3-yd. Kiesler Rehandling Clamshell Bucket, 17 in. Sheaves. New condition.

1—34-E Foote Paver. Hercules power. Perfect condition, only used on one job. Power boom.

1—New 200-bbl. Blaw Knox Cement Bin. 50 TPH. Elevator UTS.

2—20' Semi-Tool Houses. Drop deck, back and side door. Equipped with heavy bench and storage cabinets.

2—30' Engineer Offices. On rubber, fully equipped.

W. C. SCHEIRER
Frankfort, Indiana Phone 5811

FOR SALE

2 Universal Crushing Plants 293 QS Senior Plant 2036 546 P 2036.

2 Allis-Chalmers Hydrocones 636.

15,000 Lin. Ft. 14-in. or 15-in. Paving Forms.

WINKELMAN-TOMPKINS-JONES
P.O. Box 273 Phone 3274 Plattsburgh, N.Y.

FOR SALE OR RENT

1—Joy Challenger Blast Hole Drill, Model TWM-3, S/N 18368 and C-P Model R0-2 600 cu. ft. Rotary Air Compressor, S/N 56848, both mounted on D-8 Tractor, S/N 2U-197.

The drill and compressor were delivered in 1955 and have been used approximately 2000 hours. The outfit is clean, in good condition and ready to go.

For further information, contact:

R. A. YOUNG & SON, INC.
FORT SMITH, ARKANSAS
Phone: SUnset 3-8901

FOR SALE
1 CATERPILLAR D6

Having a LaPlant Choate Hydraulic dozer. Machine is narrow gauge. Series 5R. Excellent condition. Used in our sewer construction. Some years used less than 100 hours a year. Ready to go.

Must See To Appreciate

WM. MUTH
707 North 7th. St. Manitowoc, Wisc.
Ph. 22080

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300 ton 4 compartment Bin

Barber-Greene Conveyors:
3—18"x84'
1—24"x183'
1—24"x210'

1—HD14 Allis-Chalmers tractor
1—Model 7 Northwest dragline
1—Barber-Greene Bucket Loader Model 522
1—Euclid Model No. 1Z Bottom Dump

COOGAN GRAVEL CO.
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FOR SALE

270 — 10' Sections — 14"x18" Heltzel Dual Duty Highway-Airport Steel Forms.

250 — 1"x48" Steel Pins

2 — Cleveland Stake & Form Pullers w/solid Rubber Tired Wheels.

1 — Cleveland Trail Grader 24' — 26' with Transportation Wheels

1 — Gardner Denver Pin Driver

Location — Riverdale, North Dakota

Offered Where Is — As Is Subject Prior Sale

GARRISON SPILLWAY CONSTRUCTORS
Riverdale, North Dakota — Phone 633

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One Seaman Model GTM Trav-L-Plant, condition practically new, has large tires and 135 HP Gas Engine. Inspect at Sioux City, Iowa.

ANDERSON EQUIPMENT CO., INC.
306 SOUTH VIRGINIA STREET
SIOUX CITY, IOWA

FOR SALE

1 Kochring Model 302 combination shovel, hoe and crane.
1 Barber-Greene track-type trenching machine.
1 Caterpillar D17000 diesel power unit on skids.
1 Rex truck mixer mounted on GMC cab over engine truck.
1 Adams motor patrol.
1 Used 10x36 Cedarapids roller bearing jaw crusher.
1 Used 30x18 Cedarapids roller bearing roll crusher located at Rochester, Minn.
1 C. S. Johnson TY 273 dual batching bin, 55 cu. yd. capy., 2 size 34 three-material road builders batchers with interlock for Minnesota highway specifications. Used two seasons. Excellent condition. Located at Fulda, Minn.

All in good condition and reasonably priced.

RUFFRIDGE-JOHNSON EQUIPMENT CO., INC.
3024 S. E. 4th St. Minneapolis 14, Minn. FEderal 9-7937

PUMPCRETE FOR SALE

160 Single Pumpcrete on wheels with Waukesha Gasoline Engine, Pug Mill Remixer and 300 ft. 6" pipe. Completely Rebuilt and Guaranteed.

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Phone Cypress 2-4132
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FOR SALE

D-13000 Caterpillar Generator Units, 75 KW.

D-8800 Caterpillar Generator Units, 50 KW

6-71 GM Generator Units, 60 KW.

D-4400 Caterpillar Generator Unit, 20 KW.

Carver Pipeline Pump, 500 GPM, 492' Head w/Continental Gasoline Engine.

6" Gasoline Discharge Hose, 50' Lengths, Bronze Nipples and Flanges.

Large Quantity Single Drum Winches, with Level Wind.

Southwestern Supply & Equipment Company
Post Office Box 14357
Houston 21, Texas
Phone: Mission 9-2706

FOR SALE
1 - Model 625 PAGE DRAGLINE 180 ft. Boom, 8 yard bucket.
WILLIAM LUBRECHT, III
Construction Equipment
311 W. Diamond Ave., Hazleton, Pa.
Phone: Gladstone 5-4041 or 5-0253

Manufacturers' Literature

Earth Moving and Construction Machinery

A pocket-size review of the earth moving and construction machinery manufactured by the Allis-Chalmers Manufacturing Co.'s Construction Machinery Division is now available from the company's Tractor Group, Box 512, Milwaukee 1, Wis. The 2-color booklet (MS-1107) presents the line and matched allied equipment through pictures of each model tractor, motor grader, motor and pull-type scraper, and power unit, all briefly and concisely described to permit the reader to review the entire line in a minimum of reading time.

For more information circle 142 on Service Coupon Page 16 and mail now.

Heavy-Duty 3-Wheel Rollers

Buffalo-Springfield heavy-duty variable weight 3-wheel rollers in the 10-14 ton and 12-15 ton classes are shown in the new illustrated 12-page bulletin No. S-72-156 released by the Buffalo-Springfield Roller Co., Springfield, O. The two models, VM-31D and VM-32D, feature power roll brakes, tapered roller bearings on all rolls, a compact 4-speed transmission, improved hydraulic steering system, with low-torque clutches. These are a few of the many Buffalo-Springfield roller features described in the new bulletin. Operational and construction features of the Buffalo-Springfield 3-Wheel rollers are given in detail. All standard and optional equipment is listed. Data covering dimensions, specifications, weights and compressions of the VM-31D and VM-32D are given in easy-to-read tabular form.

For more information circle 143 on Service Coupon Page 16 and mail now.

Safe Loads for Slings At Various Angles

A newly revised information bulletin, No. 5308-R, available from Macwhyte Co., Sling Department, Kenosha, Wis., lists the safe loads for slings of 20 sizes wire rope when used at various angles of application. Information is listed to cover slings varying from ⅜ ton safe load to 48.7 tons safe load.

For more information circle 144 on Service Coupon Page 16 and mail now.

Mechanical Rubber Products For Contractors

A specially prepared 12-page color catalog for the construction industry listing its construction line of mechanical rubber products has been issued by Boston Woven Hose & Rubber Co. Dredging, steam, concrete, fire and water hose, belting, V-belts, packing and tape are among the products described in the new catalog. The catalog contains photos and cutaway views of each product plus informative sections on the various types, sizes, diameters, etc., available — all engineered to specific contractor needs. For copy of catalog write Department 3391E, Boston Woven Hose & Rubber Co., P. O. Box 1071, Boston 3, Mass.

For more information circle 145 on Service Coupon Page 16 and mail now.

Highway Railing of Aluminum

A booklet on highway railings of Alcoa aluminum is available from Aluminum Company of America, Room 778, Alcoa Bldg., Pittsburgh 19, Pa. With up-to-date coverage of aluminum railings available for bridges and roadways, the booklet carefully examines engineering considerations for this field. Design suggestions to foster practical and economical usage of aluminum in these applications are also presented.

For more information circle 146 on Service Coupon Page 16 and mail now.

Heat Resistant Properties of Additives

Widespread interest in the paper "Heat Resistant Properties of Additives in Asphaltic Concrete" made necessary a second reprinting. Reprints are available from Carlisle Chemical Works, Inc., Reading, O. Dr. C. F. Huber presented the paper at the 1956 Regional Meeting of the Western Petroleum Refineries Association in Houston, Tex., on Feb. 3.

For more information circle 147 on Service Coupon Page 16 and mail now.

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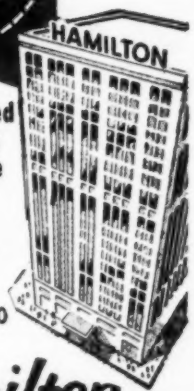
No Charge for Meeting Rooms when sleeping rooms are used



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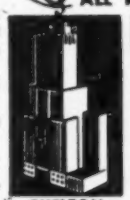

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BE SURE TO STOP AT ROYAL CREST HOTELS

With the Manufacturers and Distributors

NEW BUCYRUS-ERIE DISTRIBUTOR. Schultz Machinery Co., 1505 Main St., Bismarck, N. Dak., has been appointed distributor for entire state of North Dakota, for Bucyrus-Erie Co., South Milwaukee, Wis.

EUCLID APPOINTS BATON ROUGE DEALER. Baton Rouge Equipment Co., 425 North Beck St., Baton Rouge, La., has been appointed dealer for the complete line of Euclid earthmoving equipment in southern Loisiana.

ANDREOLI PROMOTED BY GENERAL TIRE. Joseph A. Andreoli, executive vice president of the General Tire & Rubber Export Co., has been promoted to a vice presidency of the parent firm, The General Tire & Rubber Co., Akron, O.

COFFEY APPOINTED MACK REPRESENTATIVE. Stanley J. (Bud) Coffey has been appointed western off highway equipment sales representative for Mack Motor Truck Corporation, a division of Mack Trucks, Inc., New York, N. Y. His headquarters will be in Los Angeles, Calif.

DRASTRUP APPOINTED JOY VICE PRESIDENT. A. B. Drastrup has been appointed vice president of the Joy Manufacturing Co., with headquarters in the Oliver Bldg., Pittsburgh, Pa. Mr. Drastrup formerly was president of the A. M. Byers Co.

NEW KOEHRING DISTRIBUTOR. The Edward C. Flaherty Co., 43-87 Vernon Blvd., Long Island City, N. Y., has been appointed distributor in Lower New York state for Koehring Co., Milwaukee, Wis., succeeding the R. E. Brooks Co.

SMITH NAMED PAVER SALES REPRESENTATIVE. Arthur W. Smith has been appointed paver sales representative by Pioneer Engineering Works, Inc., Minneapolis, Minn., subsidiary of Poor & Co., Chicago. His function will be to give technical assistance to Pioneer distributors in connection with all domestic and Canadian sales of the new VIBROmatic bituminous paver, manufactured by Pioneer.

AMERICAN HOIST ANNOUNCES NEW PROGRAM. The American Hoist & Derrick Co., St. Paul, Minn., has announced a new program, designed to give their equipment distributors more assistance in sales promotion and market coverage, with the introduction of a new sales development department. Don W. Martin, formerly assistant advertising and sales development manager, Schield Bantam Co., will spearhead the new program.

NEW DISTRIBUTORS FOR NAPCO LOADERS. Napco Construction Equipment Division of Napco Industries, Inc., Minneapolis, Minn., has appointed the following dealers for their Napco front-end loaders: R. B. Wing & Son, 384 Broad-

Precision-built for the man behind the gun...

Model 3000 $199.50* complete with tripod.

White gives you the most practical Universal Level-Transit on the market

HERE'S a Universal Level-Transit specially developed to handle all survey and checking operations. It's sturdy, accurate and exceptionally easy to use. And — a new single truss standard frame design replaces old-style cross bars and wyes. What's more, it has a silvered 4¼" horizontal circle and an easy to read 5 minute vernier.

Other advantages of this outstanding instrument include coated optics, internal focusing and a ball-bearing race for smooth operation even in sub-zero weather. Check out a White on your next trip and discover how much easier your work can be. Write for DAVID WHITE Bulletin 656 and name of nearest dealer, 325 W. Court St,. Milwaukee 12, Wis.

DAVID WHITE COMPANY

We offer expert REPAIR SERVICE on all makes, all types of instruments

*Prices subject to change without notice.

. . . for more details circle 305, page 16

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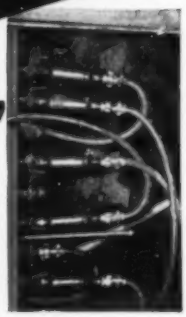
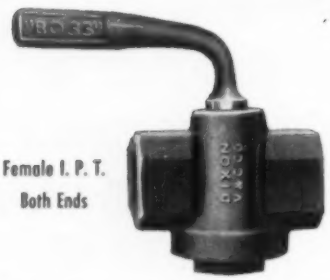


"BOSS"

Self-Honing

AIR VALVES



Female I. P. T. Both Ends

Built to withstand the hard knocks of mining and construction service, "BOSS" Valves are also ideal for general use on pipe lines, hose lines, compressor tanks, etc., and for the handling of water. They do not require packing.

Bronze plug firmly seated by spring tension against harder metal of valve body is automatically honed to perfect seat as handle is turned. A straight, full-flow opening extends through valve body and plug, providing greater capacity with no friction loss. Valve opens or closes by a quarter turn of the handle.

INTERNALLY ATTACHED HANDLE—In sizes ¾" to 1½" valve stem and handle are combined in a strong one-piece forged steel unit which is anchored to the bronze plug within the valve body. This patented feature eliminates stem and handle breakage. Sizes ¼", ⅜", ½" and 2" have externally riveted handles.

Male I. P. T. Both Ends

Stocked by Manufacturers and Distributors of Industrial Rubber Products

DIXON

Valve & Coupling Co.

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DIXON VALVE & COUPLING CO., LTD., TORONTO Associate Companies:
Dixon Company Inc., Quarryville, Pa. · Precision Drawn Steel Company, Camden, N.J.

. . . for more details circle 208, page 16

way, Albany, N. Y.; Miller Equipment Co., 538 Bond Ave. NE., Grand Rapids, Mich.; Miller Equipment Co. Detroit, 30303 Plymouth Road, Livonia, Mich.; Powered Equipment Corp., 130 Needham St., Newton Highlands, Mass.; Knight Equipment Co., 1726 Kelly Road, Richmond, Va.; Porter Supply Co., Inc., 1703 Seventh Ave., Huntington, W. Va.; Industrial Service Co., Inc., 6565 Tidewater Drive, Norfolk, Va., and Superior Equipment Co., 2402 South 19th Ave., Phoenix, Ariz. Sales and service of the new loader will be offered through all of these dealerships.

APPOINTED ASSISTANT SALES MANAGER. Mark Anthony, formerly with Anthony Co., Streator, Ill., has been appointed assistant sales manager, H. S. Watson Co., Emeryville, Calif.

NEW PARSONS DISTRIBUTOR. George Malvese & Co., New Hyde Park, Long Island, N. Y., has been appointed distributor in the lower New York state area, of the Trenchliners of Parsons Co., Newton, Ia., subsidiary of Koehring Co., Milwaukee, Wis.

CLARK NAMES TWO NEW DEALERS. Two new Louisiana dealers have been appointed to handle the Michigan line of the Construction Machinery Division of Clark Equipment Co., Benton Harbor, Mich.: E. C. Ray Machinery Co., Highway 80 Shreveport, La., has been named to sell and service the Michigan line of tractor shovels and excavator cranes. General Equipment, Inc., 435 Richland Ave. at Government St., Baton Rouge, La., has been appointed to sell and service Michigan tractor shovels and excavator crane parts only.

SMITH ELECTED PRESIDENT OF MARION. Milton T. Smith has been elected president and general manager of Marion Power Shovel Co., and of its subsidiary, The Osgood Co. In his previous capacity of vice president and general manager, he has been serving since March, 1955, as chief executive officer of both companies, which operate as part of the Equipment Department of Merritt-Chapman & Scott Corporation.

NEW GRADALL DISTRIBUTOR. Southwood Machinery Sales, RR6, Indianapolis, Ind., has been appointed a Gradall distributor by Gradall Divisions, The Warner & Swaysey Co., Cleveland, O. The territory is as follows: The state of Indiana south of Warren, Tippecanoe, Clinton, Howard, Grant, Delaware and Randolph counties, and the entire state of Kentucky.

A. S. MARLOW LEAVES BELL & GOSSETT. A. S. Marlow, Jr., formerly vice-president and general manager and a director of Marlow Pumps Division of Bell & Gossett, Midland Park, N. W., has resigned from Bell & Gossett. The move was prompted by the increasing scope of other interests which have developed so rapidly that they now require his complete time and attention.

BOLLARD JOINS COLONIAL IRON

DYNAMITE FOR SALE — Panama Canal Company has available for sale 43,150 pounds of 60% Straight Gelatin, sodium-nitrate dynamite in cartridges 4½" x 16". It is stored in Summit magazine, Panama Canal Zone, but will be delivered to Mindi Dock, Cristobal. Dynamite was purchased in April and May, 1954. There are no indications of deterioration. It is packed in wooden cases, 58 pounds to the box, but each cartridge is not individually packed for shipment. It can be properly detonated with primacord. Individual cartridges are firm and show no signs of leakage of nitro-glycerine. Sawdust in the cases is dry and free flowing. Fair price F.A.S. Mindi Dock, Cristobal, Canal zone is desired. Forward offers to Panama Canal Company, 21 West Street, New York 6,

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Printed on loose leaf, 6 hole, 6¾" x 3¾" bond paper, each book contains about 140 pages of technical data, condensed, accurate, essential, for engineer, technical worker, student, business man.

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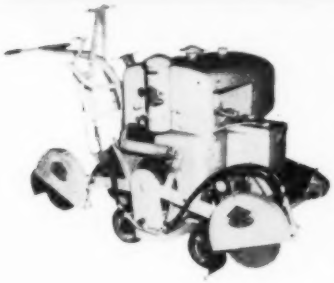

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This portable Multiblade Saw has 4 blades—cuts a 12 ft. weakened plane joint, 1½" deep, *in less than one minute.* ...Weighs less than 1100 lbs. and comes with trailer for transporting....Cuts more footage per blade. SAVES 50% TO 75% ON LABOR....24 ft. model available soon.

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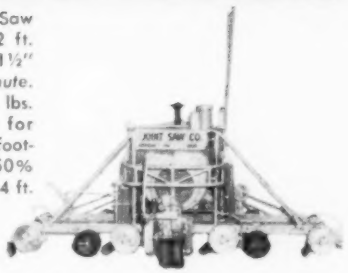

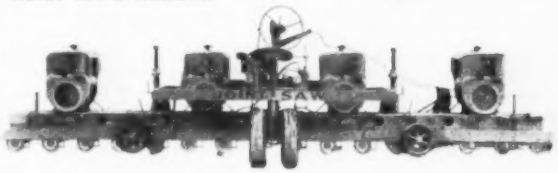

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Works. Arthur W. Bollard, formerly vice president and secretary of the F. D. Cummer & Son Co., Cleveland, O., has joined the Colonial Iron Works Co., Cleveland, Ohio, as general manager of its newly created Bollard asphalt plant division. Colonial is establishing this new division to handle design, sales, manufacture and erection of a complete line of asphalt plants and component units. Mr. Bollard will direct all activities of the division including design, sales, construction, service and installation. Mr. Bollard has been associated with the Cummer Co., for the past 34 years. He began as draftsman, and was chief engineer for nearly 20 years in charge of all design work and field erection. He was appointed secretary for the company in 1947, and was given the dual post of vice president in 1948.

Stempf Appointed Manager New Worthington Section. C. R. Stempf, formerly special representative in Madrid, has been appointed manager of the newly created standard products section of the export department of Worthington Corporation, Harrison, N. J.

New Distributor for B-E Hydrocrane. Burnup Equipment Co., Inc., 11303 Truman Road, Independence, Mo., has been appointed Hydrocrane distributor in eastern Kansas and western Missouri for Bucyrus-Erie Co., South Milwaukee, Wis. The firm will handle only the truck-mounted all-hydraulic Hydrocranes: the ¾-yd. Model H-3 with 4-ton lifting capacity, and the ½-yd. 9-ton capacity Model H-5. The new distributor is attached to Bucyrus-Erie's midwestern sales district which has its headquarters in Kansas City, Mo.

Michigan Line Dealer's Territory Extended. An extension of sales territory for the Merts Equipment Company, 300 S. Slappey Drive, Albany, Ga., distributors of the Michigan line of excavator cranes and tractor shovels manufactured by the Construction Machinery Division of Clark Equipment Co., Benton Harbor, Mich., has been announced by Clarence E. Killebrew, Clark vice president. The following counties in Georgia have been added to the dealer's territory: Effingham, Bryan, Chatham, Liberty, Long, Wayne, McIntosh, Glynn and Camden, and all requirements of the Savannah Port Authority.

Birdsall New Vice President Cummer & Son. Robert N. Birdsall has been appointed vice president and general manager and Fred E. Roedger has been appointed comptroller and assistant treasurer of The F. D. Cummer & Son Co., Cleveland, O. Mr. Birdsall, associated with the heavy construction equipment field since 1937, was for 11 years in the design and manufacturing departments of Thew Shovel Co., Lorain, O. Prior to that he was in the the Lorain County Engineers Office of the Ohio State Highway Department. In 1950 he joined the engineering department of The F. D. Cummer & Son Co., and was appointed general manager and chief engineer in 1952. He has been devoting his time to sales and engineering in the field and in plant layout, and to consultation with Cummer customers and prospects.

Thor Moves Denver Branch Office. The Denver branch office of Thor Power Tool Co., Aurora, Ill., has been moved to new, enlarged quarters at 2704 West 8th Ave., Denver, Colo. Headed by C. H. Gabriel, Thor's Denver branch manager, the branch serves Colorado, Utah, Wyoming and parts of New Mexico, Idaho, Nevada, Oregon, South Dakota and Montana.

Wicker Assumes Additional Duties. Robert L. Wicker, sales manager of the Federal Motor Truck Division, Napco Industries, Inc., Minneapolis, Minn., has assumed additional duties as sales manager of the Construction Equipment Division. Orv Reynolds will be assistant sales manager of the Construction Equipment Division.

Hudson Co. Appoints Clatt Ad Mgr. Corwin Clatt has been appointed advertising and sales promotion manager of A. E. Hudson Co., of Morton, Springfield and Rock Island, Ill. Mr. Clatt is a graduate of the University of Notre Dame. He operated a distributorship with his two brothers for the past 4½ years. Major lines represented by the A. E. Hudson Co. include International Harvester, Hough, Galion, Drott, Littleford and Thor.

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for MORRISON-KNUDSEN

A CAT* D9 Tractor with No. 9S Bulldozer is the prime earthmoving tool on this Morrison-Knudsen contract in Idaho. The job—relocating 11.37 miles of the Idaho City-Owl Creek road—involves clearing 64 acres and moving 337,000 cubic yards of dirt and rock. One rock cut is 87 feet deep and there are fills up to 30 feet.

With its huge 14-foot 'dozer, capable of handling up to 9 cu. yd. at a blade load, the D9 makes 40 passes, 200 feet long, per hour.

Now that the D9 has proved itself on jobs all over the country, owners recognize it as the top production machine among big tractors. It's the first track-type tractor with Turbocharger. The 286 HP Caterpillar Diesel Engine gives it ample power to match its weight and traction. You have a choice of torque converter or oil clutch drive. And there is "Live-shaft" drive for rear-mounted equipment.

Operators say this big machine is "as easy to handle as a small tractor." Easy to service, too. The exclusive, trouble-free oil clutch, separately removable power train components and a fuel system that needs no adjustments in the field are among the reasons why.

Your Caterpillar Dealer can give you some eye-opening facts about the economy of the D9 for big yardage jobs. Ask him for a working demonstration today.

Caterpillar Tractor Co., Peoria, Illinois, U.S.A.

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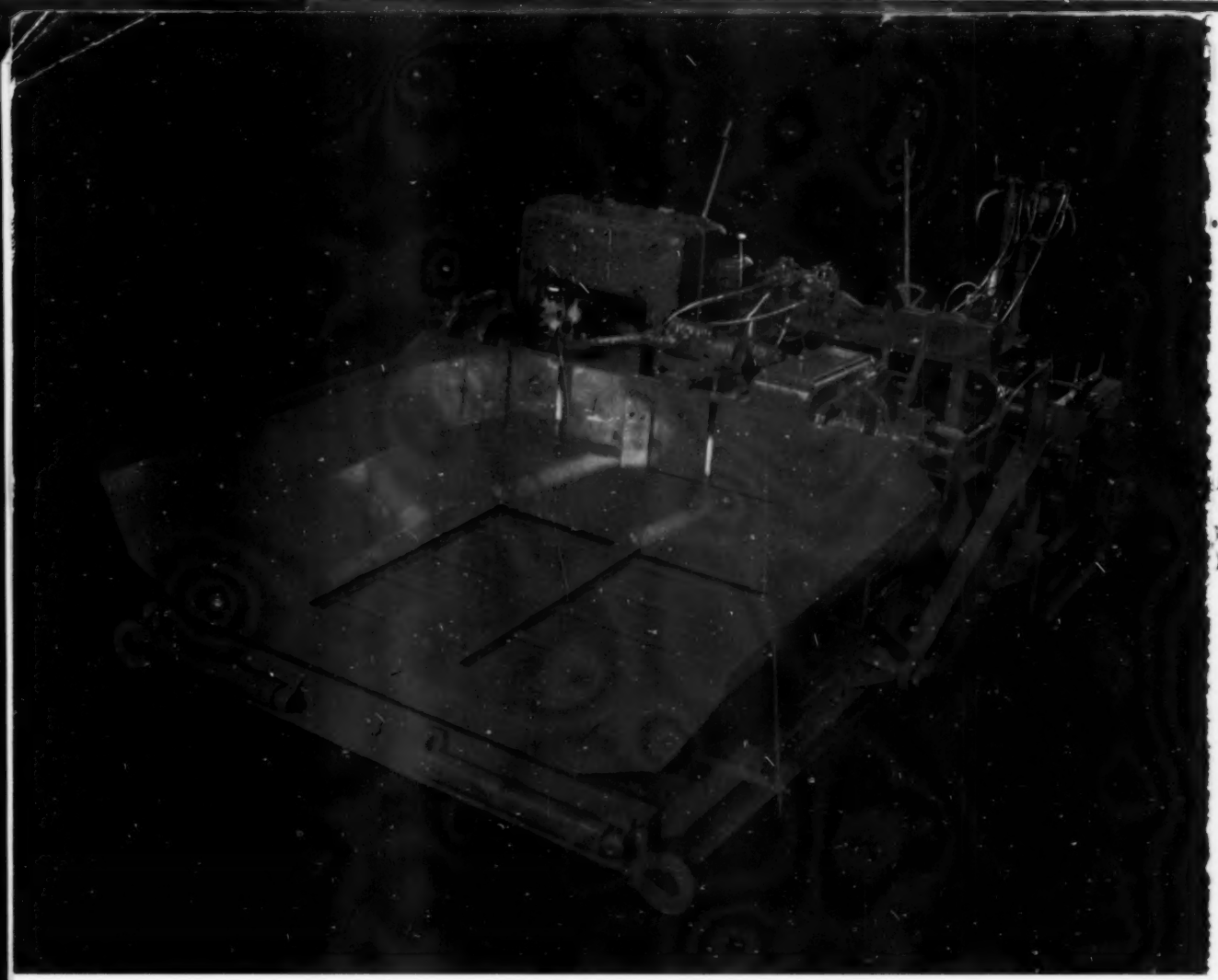

Why this new paver is the talk of the industry!

Entirely New Operation Principle

This great new Paver by PIONEER is designed to give, through an entirely new operation concept, *controlled compaction and uniform density of mat* . . . a mat having fewer voids and tears than ever before possible with a bituminous paver! The secret of the outstanding success of this paver is a radically different screed followed by a high speed, heated, vibrating compactor.

The PIONEER VIBROmatic screed is a toothed strike-off bar and pre-compactor which meters material according to the thickness of mat desired and *fills in voids across the entire mat* by means of its oscillating and VIBROmatic action, *without segregation*. The screed has a 2" heel which also pre-compacts material into place.

Density is uniformly increased by the high speed vibrating compactor which follows the screed. Heated across its entire width, it automatically and effectively irons out the mat surface.

This combined action of the VIBROmatic screed and compactor means less time lost in repairing voids and tears and the mat requires less rolling time.

Other Features That Set Paver Standards

Thickness of mat is controlled by quick-acting screws on oscillating screed and another simple device controls the crown. Fast acting finger-tip controls actuate air-over-hydraulic clutches on track drives to permit accurate hair-line steering. A toe-tip actuated air-hydraulic system controls feeding. Visibility is unobstructed; the operator can fully see the hopper, screed, compactor, steering pointer and the manner in which the mat is being laid.

The VIBROmatic has abundant reserve power, speed and capacity for laying all courses. It has laid smoother, better quality 12' mats, 2" thick at 66' per minute than any other paver can at far less speed. Furthermore, it can travel at speeds up to 2.65 m.p.h.

Simplified Maintenance

Maintenance and repair costs are lowered as "heads-up" engineering developed these features: the hydraulic motors which operate the screed and compactor are readily accessible . . . the vibrator shaft is simple . . . drives are straight and powered through steel roller chains and cut tooth sprockets. And, compactor pads are replaced quickly.

For more information write Pioneer Engineering Works, Inc., Minneapolis 13, Minnesota (a subsidiary of Poor & Co., Chicago) or see your nearest Pioneer Distributor.

VIBROmatic
BITUMINOUS PAVER
BY Pioneer®

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